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OF THE

Fifteenth International Congress on Hygiene and Demography

WASHINGTON

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VOLUME V

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Hygiene of Traffic and Transportation

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SECTION VII.

HYGIENE OF TRAFFIC AND TRANSPORTATION.

REPORT OF THE SECRETARY.

Dr. Rupert Blue, *President of Section VII,*
Fifteenth International Congress on Hygiene and Demography.

Sir: I have the honor to present a report of the proceedings of Section VII (Hygiene of Traffic and Transportation) of the Fifteenth International Congress on Hygiene and Demography, meeting in Washington September 23 to 28, 1912, together with such manuscripts of the papers read as have been delivered into my hands.

Monday, September 23—2 p. m.

The first session was called to order by the president, Dr. Rupert Blue, who announced the following honorary presidents of Section VII:

Prof. Dr. Hermann Tjaden, Bremen, Germany; Dr. Meriggio Serrati, Rome, Italy; Dr. Peter H. Bryce, Ottawa, Canada; Dr. D. Romeyn, Breda, Holland; Dr. William T. Sedgwick, Boston, Mass.

The section then went into joint session with Section VI. For program see the report of the secretary of Section VI.

Tuesday, September 24—9.15 a. m.

The joint session with Section VI was continued on Tuesday morning. For program see the report of the secretary of Section VI.

Tuesday, September 24—2 p. m.

The session was called to order by the president, Dr. Rupert Blue. The following papers were read in the symposium on the powers and duties of government in respect to the hygiene of traffic and transportation:

Interstate-Commerce Law in Relation to the Public Health, by Hon. Judson C. Clements, Interstate Commerce Commissioner, Washington, D. C.

Hygiene of Traffic and Transportation in Norway, by Prof. Axel Holst, University of Christiania, Norway.

The Treatment of Railway Employees in Holland, by Dr. D. Romeyn, Medical Superintendent of Sanitation to the Dutch Railway State Council, Breda, Holland.

Consideration was then given to the subject of the hygiene of street and tramway traffic. The following papers were read:

Die gesetzliche Bekämpfung des vermeidbaren Lärms, by Dr. Siegmund Auerbach, Frankfurt a. M., Germany.

Sanitation of Street Cars, by J. C. Hallock, deputy chief engineer, department of public works, Newark, N. J.

Transportation and Urban Health, by Benjamin C. Marsh, secretary New York Committee on Congestion of Population, New York City.

WEDNESDAY, SEPTEMBER 25—9.15 A. M.

The section met to consider the topic of the sanitation of roadbeds and stations. The following papers were read:

An Attempt at Cooperation in Railway Sanitation, by Dr. E. R. Kelley, State Commissioner of Health, Seattle, Wash.

The Remedy for the Prevention of Diseases Communicated through Toilets in Use on Railroads, by Dr. H. Taylor Cronk, New York City.

Hygiène du service des transports en commun, by Dr. Leopold Melis, Brussels, Belgium.

Sanitation of Railway Camps, by Dr. T. D. Tuttle, executive officer Montana State Board of Health, Montana.

In the symposium on the sanitation of railway carriages the following papers were read:

A Further Study of the Ventilation of Sleeping Cars, by Dr. Thomas R. Crowder, Chicago, Ill.

Vorschriften für die Desinfektion der Strassen- und Eisenbahnwagen, by Dr. Gustav Wagner, Berlin, Germany.

The remainder of the session was given over to consideration of the subject of the sanitary supervision of merchandise in transportation. The following papers were read:

The Hygiene of the Transportation of Animal-Food Products by Rail, Boat, and Wagon in the United States, by Mr. Robert M. Chapin, Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C.

The Economic Problems of Milk Distribution in their Relation to the Public Health, by Dr. John R. Williams, secretary Milk Commission of the Medical Society of the County of Monroe, Rochester, N. Y.

THURSDAY, SEPTEMBER 26—9.15 A. M.

The session was called to order by the president, Dr. Rupert Blue. Papers were presented in the symposium on the protection of the employees of common carriers as follows:

Prevention of Accidents: Examination, Education, and Care of Employees of Common Carriers, by Hon. J. D. M. Hamilton,

claims attorney Atchison, Topeka & Santa Fe Railway System, Topeka, Kans.

Organized Relief, by Mr. S. R. Barr, superintendent relief department, Baltimore & Ohio Railroad, Baltimore, Md.

The Accident Problem of the Railroads, by Dr. Francis D. Patterson, chief surgeon, Philadelphia & Western Railway Co., Philadelphia, Pa.

Der Kampf gegen den Alkoholismus bei der Eisenbahn, by Dr. Conrad Gaye, Bahnarzt in Stettin, Germany.

Legal Provision for Restriction of Alcoholism among Employees of Common Carriers in the United States, by Prof. Reid Hunt, United States Public Health Service, Washington, D. C.

Papers dealing with the subject of the protection of passengers were presented as follows:

The Protection of Railroad Passengers, by Dr. Henry M. Bracken, secretary and executive officer, Minnesota State Board of Health.

The Necessity for the Maintenance of Sanitary Departments by Common Carriers, by Dr. Arthur M. Hume, chief surgeon, Ann Arbor Railroad, Owosso, Mich.

Food, Water, and Ice Supplies in Railway Stations and Railway Trains, by Dr. S. J. Crumbine, secretary State Board of Health of Kansas, Topeka, Kans.

The following members of the congress joined in the discussion:

Dr. A. J. McCannel (North Dakota), Dr. J. W. Kerr (Washington, D. C.).

Thursday, September 26—2 p. m.

Dr. Rupert Blue presided during the afternoon session.

The subject for consideration was the hygiene of ships and shipping. The following papers were read:

The Disposal of Sewage into Tidal Waters, by George A. Soper, Ph. D., president Metropolitan Sewerage Commission of New York.

The Advance in Quarantine Incident to the Opening of the Panama Canal, by Asst. Surg. Gen. L. E. Cofer, United States Public Health Service.

Better Sanitation for Ships' Crews, by Dr. J. S. Purdy, chief health officer for Tasmania.

Friday, September 27—9.15 a. m.

Joint session with Section V. For program, see the report of the secretary of Section V.

FRIDAY, SEPTEMBER 27—2 P. M.

The session was called to order by the president, Dr. Rupert Blue. The following papers were read in the symposium on the supervision of emigration and immigration:

The Distribution of Immigrants, by Dr. Peter H. Bryce, Ottawa, Canada.

Sanitary Service on Ships Carrying Italian Emigrants, by Dr. M. Serrati, of the Royal Italian Navy (attached to the Royal Italian Consulate in New York).

Problems of Immigration from a Hygienic Standpoint, by Dr. George W. Stoner, chief medical officer, Immigration Station, Ellis Island, N. Y.

Immigration with Reference to its Causes and its Effects upon the Growth and Ethnical Character of the Population of the United States, by Dr. M. V. Safford, United States Public Health Service.

Some Thoughts on Sanitary Questions Concerning the Immigrant in his Home Country and in the United States, by Dr. Jean Constas, Washington, D. C.

Twin Navigation; the Means of Safeguarding Life and Securities on Sea, by Dr. Miguel Beccerro de Bengoa, Uruguay.

Reports of discussions as given to the secretary will be found in the transactions of this section.

Respectfully submitted.

Dr. JOHN W. KERR,
Secretary of Section VII.

TUESDAY AFTERNOON, SEPTEMBER 24, 1912.

INTERSTATE-COMMERCE LAW IN RELATION TO THE PUBLIC HEALTH.

Hon. JUDSON C. CLEMENTS, Interstate Commerce Commissioner, Washington, D. C.

One of the crowning glories in the world's progress which we of the present time have been permitted to witness and enjoy is the magnificent achievements of the scientists of the medical profession. There is no greater secular work in which man is engaged, no higher ambition than that which has for its end the healing and elimination of disease, the banishment of pain, and the lengthening of man's days, with attendant comfort, all making for his highest physical, intellectual, and spiritual development.

I therefore esteem it an honor to be accounted worthy of discussing before you one of the subjects to be considered at this gathering. Interstate commerce law in its relation to the public health presents two general questions—one of law and the other of fact—which, for the purposes of this occasion, it seems to me both necessary and sufficient to consider. I regard the discussion as useful with reference to further legislation, rather than to the meager statutes now in effect. The necessity for, as well as the nature and scope of, additional legislation depend upon existing facts and conditions. We will first consider the question of law, which goes to the constitutional authority of the Congress in the premises.

The exclusive authority of Congress, under the commerce clause of the Constitution, is much more extensive than has so far been exercised. Its exercise being permissive and not compulsory, there has resulted a line of judicial decisions to the effect that a particular subject matter of interstate or foreign commerce, within the scope of congressional authority which has not been exerted, may within certain limitations be dealt with by the States, subject to later exertion of the paramount authority of the Federal Government. All of this has resulted in a confusion of ideas as to the scope and limitations of State and Federal powers, and to a great extent throughout the country in a lack of thorough and efficient control, attainable only by uniform regulation in the exercise of the plenary power of a single authority. The clause of the Constitution vesting in the Federal Congress the power to regulate commerce among the States

and with foreign nations is without condition and is therefore absolute, except as qualified by further independent clauses of this instrument, such, for illustration, as the inhibition against the taking of private property for public use without due compensation, and that no person shall be deprived of life, liberty, or property without due process.

Although the Federal authority on this subject was as ample on the day the Constitution was adopted by the States as it is to-day, it was about 60 years after the first railways were constructed before there was any attempt on the part of Congress to control or regulate in any substantial manner the rates and practices of carriers affecting the rights of their patrons and the public, and a still longer period elapsed before there was an exercise of congressional authority in respect to safety appliances and practices designed primarily for the protection of the lives and limbs of their employees.

In the earlier stages of our country's development there was not the same practical necessity for regulation of carriers or the instrumentalities of commerce, both by land and water, as became manifest with our rapidly increasing and congested population, multiplication and growth of great cities, and the establishment of great systems of railways out of previously existing independent short lines. Congress naturally refrained from the full exercise of its authority until the necessity therefor arose. Both the original act to regulate commerce, passed in 1887, and the original safety-appliance act of 1903 have been greatly strengthened and extended by numerous amendments, and have been upheld by numerous decisions of the Supreme Court under the commerce clause of the Constitution. It is not to be forgotten, however, that at every stage of the development of these two systems of legislation the constitutionality of each and every important provision thereof has been challenged, both when the legislation was under consideration and in the course of its administration and enforcement. It was stoutly contended by able debaters in Congress that the regulation of commerce itself and that of the instrumentalities by which it is conducted were separable, and that the authority of Congress extended to the one and not to the other; but this discussion will not permit citation in detail and analysis of the numerous cases decided by the Supreme Court determining the various contentions which were presented during the period of nebulous uncertainty when profound lawyers and jurists, as indicated by their utterances, had not reached the full conviction and certainty of views respecting these questions which have been more recently reached since Congress and the courts have been brought closer to the exacting situation and inexorable conditions. It seems clear that it is conclusively established that the power of Congress is ample for the control of the rates, regulations, and practices of carriers

engaged in interstate and foreign commerce within this country, including the use in the public service of the instrumentalities of this commerce, so far as may be necessary for the full protection of the interests of the public and the patrons of the carriers, to the end that rates shall not be unreasonable, and that rates, regulations, and practices and the use of facilities shall not result in unjust discrimination, and to the extent necessary for the protection of the lives and limbs of their patrons and employees.

There has also been important Federal legislation, as developments have shown the necessity therefor, to prevent the spread in the conduct of interstate commerce of contagious diseases both among people and live stock. This legislation has also been sustained by the courts. There comes now into prominent view the question of the power of the Federal Government to regulate not only common carriers by land and by water and the use of the instrumentalities of commerce as affecting the public health, but also the conduct of individuals and communities in the pollution or contamination of these highways in such manner as to affect the public health. In view of the firmly established authority of Congress, exemplified in the legislation above referred to and so fully sustained by the Supreme Court, it seems hardly to be a debatable question that Congress has power to amply legislate in the interest of the public health for the protection, through the agencies of the Federal Government, of the highways, whether by land or water, of interstate and foreign commerce within its jurisdiction. Since it has been established that it may regulate the rates and practices of carriers to the end that they shall be free from injustice, and the instrumentalities—cars, engines, etc.—to the end that life and limb may be protected, and to the end that contagious diseases may not be communicated from one part of the country to another among people or live stock, by what reasoning can it be said that the highways themselves and the use thereof may not be regulated in the interest of the public health, although the commerce and instrumentalities which move over them may be? Since Congress has authority, as exemplified in existing legislation, to prevent by regulation and inspection the putting up for use and transportation in interstate commerce of adulterated or deleterious foods and medicines and to prevent the pollution of society by the suppression of the white-slave traffic, how can it be doubted that it has equal authority to see to it that the highways of commerce under its exclusive control are not subjected, either by the carriers or others, whether individuals or communities, to pollution destructive of the public health?

Is it conceivable that under the commerce clause Congress may provide for the correction of rates, regulations, and practices of carriers and require uniformity of drawbars, coupling devices,

brakes, and the use of handholds, ladders, steps, and running boards on cars, regulate the equipment and inspection of locomotive boilers, prescribe the manner and method of packing and handling in interstate commerce of inflammables, explosives, and other dangerous articles, legislate to prevent the dissemination of disease among live stock through the instrumentalities of interstate commerce, and yet be without power to prevent by suitable legislation and regulation abuses in the use of the highway itself?

Suppose it should appear as a matter of fact that by reason of the pollution or contamination of the roadbed, the stream, or the harbor there is more danger of the germination and spread of disease than in the moving of interstate traffic and the cars or boats in which the same is transported. Would we in that situation say that Congress is all powerful for the regulation of the minor causes of disease and death and impotent as to the greater cause? Shall we accept a conclusion that while it may deal with the incidents and instrumentalities of transportation, Congress may not by regulation touch the highway itself? I do not subscribe to such a latitudinarian construction of the Constitution as will ignore a rational observance of the fact that the Federal Government is the creature of the States and the people thereof, and that it is a government of delegated and specific powers with limitations, and that the States are sovereign entities with respect to their reserved powers. On the other hand, I do not for a moment yield to a doctrine of such strict and rigid construction that it would so limit and qualify the powers of the Federal Government as to make it impotent for the purposes for which it was created.

Congress has exerted its authority in the control of commerce over telephone and telegraph service (including wireless telegraphy) in interstate commerce. Can it be doubted that, if necessary to the safe and uninterrupted use of the wireless in the public service Congress may properly regulate its legitimate use so that it may not be impaired or thwarted by meddlers?

The people of the 13 original Colonies, shortly after their independence was achieved and recognized, clearly foresaw that for some general purposes there was necessity for a concentration of certain powers in one government. One of the most important matters committed in the interest of all to the exercise of a single authority was the regulation of commerce among the States and with foreign nations, and it was committed, not to be placed in a state of dormancy and nonuse, but for the purpose of vigorous exercise in behalf of the whole people. If the Supreme Court had been induced to adopt a narrow construction limiting the power of Congress to the commerce itself, as separated from the incidents and instrumentalities thereof, and the highways whereby it is conducted, this delegation of so-called

authority to the Federal Government would, indeed, have been a sham and a delusion. Necessarily and rationally there was included in the express and unqualified delegation of this authority the right to choose and adopt the most appropriate means for giving effect to the purposes in view.

We have continual demonstration of the wisdom of the framers of our Federal Constitution in the application of its everliving principles to the ever-changing conditions incident to progress.

By what process of reasoning shall we put out of view the general welfare as it is affected by the necessary protection of the public health from the baneful and destructive effects of an improper use of these highways of interstate commerce? It is not necessary for me, in this connection, to contend for unlimited authority on the part of Congress to initiate agencies and means for the general promotion of health as an affirmative and independent procedure. I am discussing not only the authority, but the moral obligation, of the Federal Government to see to it that in the use of the highways and instrumentalities of interstate and foreign commerce under its exclusive control they are not made vehicles for the dissemination of the germs of disease and death.

While this question of Federal authority probably would have been open to serious debate a few decades ago, it scarcely seems open now, and this I say from the standpoint of one who fully believes in the vigor and power of the reserved rights of the States.

Let us now come to a consideration of the second question, namely, whether the facts and conditions are such as to demand additional legislation on the part of Congress in the further exercise of its power in the control of interstate and foreign commerce with a view to protecting the public health. Upon the members of your profession Congress and the public must rely for authoritative information respecting the necessity for further legislation and the specific purposes at which it should be aimed. Both Congress and the people are accustomed to demand satisfactory showing, amounting approximately to a demonstration, of the reasons and justification for important new legislation before seriously considering it. A demand for legislation resting upon possibilities, unestablished theories, and even probabilities is seldom acted upon favorably, especially when it involves large expenditures, a new departure in legislation, or the unaccustomed exercise of authority.

The theories of the men of your profession as to the extent to which the germs of disease are transmitted through contaminated or polluted waters have been in the past more or less questioned. When we look to the histories of older countries in other crowded times and climes, as in southern Europe, respecting their pathogenic conditions, the spot light is thrown upon the cholera, the plague, the black death,

contagions communicated by air-borne germs. But, in the light of experience, investigations, and knowledge acquired by your profession, it now seems probable that the water-borne mites are no less fatal, and have exacted from mankind a toll of death and sorrow beside which the plagues that have from time to time swept localities seem but "one-night stands."

Our ignorance of the conditions under which the ancients lived precludes us from intelligent comparison by which to measure the death toll that polluted waters may have exacted. That the ancients were intelligent enough to want clean water and to know how to get an ample supply is demonstrated by the remaining ruins of magnificent aqueducts beside which our own, if practically superior, it must be admitted are architecturally inferior.

At Pompeii you can hear the water gurgling in the conduits, making the same music it made nearly 20 centuries ago. At Verona and Rome the great circuses still show the underground canals by which the arenas could be flooded and the populace amused by naval combats without going to sea.

The one thing needful to justify prompt and comprehensive action by Congress in dealing with the matter of public health, as affected by interstate commerce, which would be approved by the people, is authentic and reliable information as to approximately what extent and in what manner the public health is injuriously affected by interstate commerce, and the highways and instrumentalities by and over which it is conducted, whether by land or water.

If the common drinking cup in the passenger coach, now rapidly disappearing under the inhibitions of State laws, was a menace to health, may it not be true that the daily discharge from the passenger trains traversing our 240,000 miles of railway, whereby that which is cast out one day is taken up into the air in the form of dust and breathed by the passengers of the next day, to say nothing of those living in communities along the lines who might be affected, is a source of disease manifoldly greater than the common drinking cup? If the theories upon which are based some of the hygienic requirements in the localities and homes of those affected by typhoid and some other diseases are correct, the above question must certainly be answered in the affirmative; but again I say the question is one for the experts of your profession, and theoretical disquisitions in the medical journals and papers, prepared with however much conscientious thought and care, in a matter of this kind involving a serious exercise of extended authority and large expenditures, though immensely valuable, do not fully answer the purpose in convincing Congress or the public of the justification for a new and important departure in regulation.

What I have just said with respect to the question of the possibility or probability of the dissemination of disease by a polluted or contaminated rail-highway applies with equal and perhaps greater force to highways by water, and especially to the streams or lakes from which communities obtain their supply for drinking and household purposes.

When a great disaster like that of the *Titanic*, or even much smaller ones, such as occur in the collisions on our railways and in mine explosions, take place, the whole country is shocked and there is a universal demand for adequate and practical regulation which will prevent a recurrence of such disasters; yet the great list of deaths occurring in the operation of our railway service is more largely made up of the one, two, or a few that are killed daily in what are termed "small accidents" which are seldom heard of beyond the neighborhood in which they occur. So, doubtless, does the continuous daily and nightly toll upon the lives of the great body of the people, by the deadly germs or seeds of death and of disease, prepare for the great harvest, Death, rather than the occasional local so-called scourges, which prevail for a limited time in a limited territory, but which greatly excite the sympathy and interest of the people in general; while the steady, stealthy, daily harvest of one here and a few there in each and every community goes on without producing any great shock to the general public or attracting any such interest on the part of the masses as to ripen into a positive demand for adequate prevention by suitable legislation and regulation.

Extended activities of government in matters of public regulation are always objected to, and it is often said that the people who are governed least are governed best. The correctness of this contention depends altogether upon the extent to which a people as a whole have reached such a realization of individual responsibility and appreciation of the rights of others as to render regulation unnecessary. Happy is that people whose standards of life and conduct are such as to require little government, and I would suggest that that people is governed best whose government adequately protects the rights of each and all according to the necessities of the situation. Little or no government would be necessary if all the people had reached the high plane of the Golden Rule, but a comparatively small minority may render drastic regulations necessary for the protection of the great body.

Objection is made to the number of agencies and employees necessary to enforce regulations. The necessity for expenditures for inspection and administration in connection with the enforcement of requirements affecting the public is to be regretted; nevertheless, it has been found necessary to protect the public against wrongs and

impositions of many kinds, as for instance, the adulteration of foods and medicines, and considerations of this sort ought not to cause the Government to hesitate in the exercise of its authority to such an extent as ascertained conditions from time to time require. We would be as shortsighted as those of old who took tithes of anise and cumin, neglecting weightier matters, if we should content ourselves with the regulation of matters of dollars and cents as involved in transportation rates and in the protection of cattle from contagious diseases, and stand aghast at the more important matter of human life and death, if indeed the conditions be such, as has often been contended by eminent representatives of your profession, that the public health is greatly impaired by the pollution and contamination of the highways of interstate commerce by land and by water.

Again I repeat that the need of the hour is a demonstration of the truth, in order that the public may be sufficiently informed so as to sustain any action that may be necessary for the adequate protection of its health, and that those charged with the responsibility of exercising the powers of the Government may be informed to a reasonable certainty as to the situation with which they have to deal.

It is a matter for congratulation to those interested in this all-important subject that Congress has taken an important step, by the act approved on the 14th day of the last month, in the reorganization of the Public Health Service, the latter being invested with authority to study and investigate the diseases of mankind and the conditions influencing the propagation and spread thereof, including sanitation and sewage, and the pollution, either directly or indirectly, of the navigable streams and lakes of the United States; and to issue bulletins for the information of the public. It is devoutly hoped that this agency will be amply equipped with the necessary means to fully investigate these questions and to give to the public and to Congress authentic and demonstrable truth. When this has been done it can not be doubted, in my judgment, that whatever additional legislation may be necessary to reach the evils ascertained, is within the power of Congress, and will be promptly forthcoming.

The Public Health Service calls for the highest order of professional efficiency and individual integrity, courage, and zeal. The work before it is of the greatest importance, and can not be pursued without encountering numerous obstacles and difficulties, and faith in it will not be lacking, owing to the oft-repeated demonstrations of the noble spirit of daring and self-sacrifice in devotion to the high calling of the profession in the interest of humanity. A recent illustration of this, comparable to many others in the past, is that of the labor and sacrifice of Dr. Thomas C. McClintick, and the service is not without another among its ranks ready and willing to promptly take his place.

HYGIENE OF TRAFFIC AND TRANSPORTATION IN NORWAY.

Prof. Axel Holst, University of Christiania, Norway.

STREET TRAFFIC.

The laws of Norway do not contain many provisions for the supervision of street traffic. This is almost entirely relegated to the local authorities, who have a right to draw up police by-laws with such provisions for protecting the public order and security as they may deem necessary.

The regulations which are in force in the capital of the country, Christiania, are as follows:

Sanitation of pavements and roadways.—For pavements, as a rule, paving stones are used. In some streets with light traffic tar macadamization is used, and in central streets with heavy traffic, wood-block pavements. The use of asphalt on the roadways has several times been contemplated, but until now the plan has not been realized, though asphalt, as regards sanitary matters, is considered the best covering for roads. In markets, stands for horses, etc., impermeable pavements only are used; as a rule, paving stones put in cement on a beton foundation and faced with cement mortar. The cleaning of stands and markets is effected by irrigation and by sprinkling and machine sweeping. The streets with most traffic are swept every day. Elsewhere, sweeping is done every second or third day, rarely at longer intervals. Every public street, however, is swept at least once a week. In dry weather the streets are sprinkled to the extent necessary for binding the dust. In the summer the busier streets are sprinkled many times a day. Tar coating has of late been used as a means for laying the dust.

Regulations of vehicles.—For protecting street traffic against risks and inconveniences by vehicles, the municipal authorities have the power of prohibiting cycling in parks and in the busier streets; they can also wholly or partly prohibit driving in certain streets under certain circumstances. They can order that certain kinds of traffic (e. g., transport of manure) shall keep to fixed routes.

Horses that are broken, lame, emaciated, or disposed to run away shall not be used in public streets. Horses being disposed to bite shall have a muzzle. Inhabitants of the town and cabmen driving for fares inside the town shall use carriages with springs. Exceptions, however, are allowed in certain cases.

Driving or riding shall not be intrusted to any person that is drunk or for any other reasons is unable to manage a horse. The person who confides a carriage, a horse, or a cycle to anyone under 15 years of age is responsible for the penalties the latter may incur.

Drivers, riders, or cyclists shall always keep to the right.

In public streets, gateways, or like places having free exit to a public street, drivers or riders shall not leave a horse unless it is under responsible care or is made sufficiently fast in a manner that is further determined.

There are some special regulations for motor cars. Before being put in use they shall be examined and approved by the police. Similar examination is made of the chauffeur, who shall not be under 21 years of age. The cars are registered and numbered by the police. As a rule they shall not be wider than 2 meters. Further details with regard to brake apparatus and alarm bells are given.

As to cleanliness, the by-laws decide, amongst other things, that for the transport of manure tight iron cases with close-shutting lids shall be used. Manure shall not be transported at any other times of the day than those indicated by the police, acting in conjunction with the local board of health. Wagons for the transport of earth, sand, coal, lime, etc., shall be so tightly built that nothing may be spilled. For the transport of unslaked lime the wagon, in addition to this, shall have a lid or other secure cover.

If any cabman wishes to stand with a carriage on market places, public streets, or drivers' thoroughfares within the town or its nearest surroundings he shall have a license from the police. All licensed cabs are numbered. In snow and rain the horses shall be covered with a black oilskin; in cold weather, on the rank, with a rug. The cabmen themselves shall also be approved by the police. Every licensee may pull up at stations and quays; but he shall be provided with a brass badge on which the number of the cab is inscribed. He delivers this badge to the policeman on duty. Those of the arrivals who desire a cab obtain a badge from the policeman and engage the cabman to whom the badge belongs.

Control of street trades.—Cabmen who wish to stand on the town ranks for transporting goods and merchandise shall also have a license from the police.

No one has a right, without permission from the police, to stand in a public street for the purpose of selling. The seller shall not stand in any other place than the one indicated in his permit. Children are not allowed to engage in any trade or profession in public streets or places after 10 o'clock in the summer and after 9 o'clock in the winter. Children who have obtained police permission to stand as messengers or porters shall wear badges. They, themselves, and their baskets and carriages shall be clean.

Newsboys must not be under 10 years of age. They also shall wear badges. Fresh meat, pork, fish, bread, and confectionery, when being transported in the streets or in open air, shall be covered in such a way as not to be exposed to dust or other uncleanliness, or to the sunlight or the rain, whereby they may become less fit for food.

As to market trade, the municipal authorities decide (1) which of the public places may be used for such trade; (2) what sort of trade may be carried on at each place; (3) at what hours the trade shall proceed (as a rule between 8 a. m. and 2 p. m.). In the markets people are allowed to sell the produce of agriculture, horticulture, hunting, fishing, and domestic industry. Butter, cheese, and smoked salmon shall not be divided, but be sold as they are brought to the market. All kinds of foods shall be laid in clean cloths, vessels, or carriages. There shall be, under meat in carriages, a clean cloth. Persons concerned with the transport of meat shall always be clean, and wear a clean smock and head covering. They shall also have a clean towel for covering hair and neck when bearing meat upon their shoulders.

Those who meet at the markets for the purpose of selling shall observe the directions given by the police. They shall not cast spoiled foods or offal into the market place. On the expiration of the market time all merchandise, carriages, tables, etc., shall be removed.

Prevention of noise.—There are not many provisions or devices for the prevention of noise. An act of May 27, 1887, that applies to the whole country, decides that no one shall ply any trade or profession causing extraordinary or unforeseen annoyance to his neighbors, e. g., by noise. In deciding if an annoyance is extraordinary or unforeseen the local circumstances enter into consideration; that is, if the place in question is fit for industrial trades, or if factories or the like have existed before in the neighborhood. Those who infringe this law can be prosecuted only by private indictment.

In accordance with the police by-laws, the municipal authorities can decide that noisy occupations, e. g., boiler clinching or coopering, shall not be followed during the hours between 10 p. m. and 6 a. m.

Immoderate and noisy behavior in public restaurants is prohibited. The police can order the closing at 10 p. m. of public amusement places, e. g., skittle grounds, if these annoy the neighbors.

In a public street shouting, shooting, and loud singing are prohibited. The police can, however, under special circumstances, permit singing until a certain hour in the evening. If anyone desires to make music in a public street, he must have permission from the police. In case of illness, or for any other reasonable ground, any inhabitant in the neighborhood can insist upon the withdrawal to a proper distance of the musicians.

Prevention of accidents.—The act of May 3, 1871, decides that manufacture of nitroglycerin, dynamite, gunpowder, and the like shall not take place in towns. Nor is it allowed, in towns, to keep or possess more than 5 pounds of dynamite and 10 pounds of powder. Exceptions from this rule may be allowed, but under rather strict

safeguards. Importation of and trading in such articles shall be notified to the police. Strict regulations are laid down for the transport of explosives. Manufacture and refining of petrol and the like inflammable fluids are also prohibited in towns. The keeping of unrefined paraffin oil is prohibited, and as to the other fluids the act determines the amount which may be kept.

The police by-laws of Christiania contain a series of special regulations for the prevention of accidents during digging, mining, and in lifts, areas, insecure boardings, etc.

In or over a public street no one shall shoot with gun, bow, etc.; let off fireworks, flash powder, or other explosive substances; throw stones, soil, water, or other things whereby harm may be done or the traffic inconvenienced. During slippery weather the police can charge the owners of premises with the sanding of sidewalks.

Since 1898 a private station for immediate medical aid has been in operation. It is situated in the center of the town, and medical aid can be ordered at every hour of the day and the night. The town pays a yearly contribution of 1,500 kroner, and the physician on duty is thus bound to render medical assistance without security for fees. The station is used chiefly by people in the city and the west end.

In 1910 a municipal station was established for the northern and eastern parts of the town. It is organized in the same manner as those in Copenhagen and Stockholm. A certain number of physicians undertake, in rotation, to remain in office and to render assistance at certain hours of the day and the night. If the patient can not pay the fee, the physician obtains a certain fixed amount from the town. The police stations may be used as intermediaries between the public and the physicians on duty.

Those of the patients who need surgical or infirmary treatment are directed to the hospitals of the State or the town.

At all police stations there are stretchers and bandage materials. Besides this, there is an ambulance car at the head station in the east end, ready for use in case of accidents.

Maintenance of comfort stations.—At the present time all public conveniences are overground. This year, however, a beginning will be made in underground arrangements.

The town has 73 public urinals, as a rule built of cast iron and covered inside with slats up to a height of 1.60 meters above the ground. The urinals in the center of the town are inspected twice, elsewhere once, daily.

The number of public closets and lavatories is now 14. Two of these (closets) are gratuitous, but are used almost exclusively by men. They are washed every day, but have no constant caretakers. Two closets have rooms both for gratuitous use and for hire. In the remaining ones there is a charge—10 are for first class and 3 are for

second class. They usually contain 3 to 4 rooms for women and 3 to 4 rooms for men, besides a caretaker's room. All the closets are dry closets, with movable tanks of galvanized sheet iron. The tanks are emptied one to three times a day. First-class closets are provided with looking glass, washstand, towels, and soap. The buildings are oil painted inside and outside. The town council has considered the question of making all closets free. But there is no common wish for this amongst the public, who find in the charges some security for cleanliness.

Regulation of street pageants.—The police are empowered to regulate, and, if necessary for protecting public order and security, to prohibit parades and pageants.

TRAMWAY TRAFFIC.

Owing to the important public interests involved in tramways, for the laying down of them the law requires, in country districts, a concession from the Government, and in the case of towns a concession from the town council (with the subsequent approval of the Government).

At present public tramways exist in four towns only: Christiania, Bergen, Trondhjem, and Drammen. They are all under private ownership, except in Trondhjem, where they are owned by the town. The motive power is electricity, with overhead conductors. In the three first-named towns the cars move on rails; in the last one, on the road itself. Undergrounds and subways do not exist as yet, but in Christiania an underground tramway has been planned, and will be completed in a few years.

The tramway traffic in Christiania is divided between two companies, which have a concession for a certain period, after the expiration of which the town has the right to take it over at a valuation. Regulations for the traffic are drawn up by the municipal authorities. In accordance with these regulations, every car, before being put into use, shall be inspected by the commissioner of public works and by the police. It shall be kept clean and in good repair. It shall be fitted out with signal apparatus, alarm bells, and lanterns, and shall be sufficiently lighted. Doors and windows shall be tight and shall not be of dull or colored glass. The stopping places shall be sufficiently lighted after dark. The maximum speed allowed is 300 meters per minute. When the least distance between two cars meeting in curves does not exceed 20 centimeters provisions shall be taken for preventing passengers from leaning out toward the other line. Every car shall be provided with a plowlike frame in front of the wheels and not more than 10 centimeters above the rails. If this is impossible on account of snow and ice, the board must not be more

than 5 centimeters above the road. At the same height a board shall surround the sides of the wheels. Halts between stopping places for taking up or setting down passengers is forbidden. In case of double lines, the cars shall always keep to the right, the platform doors on the left side being shut. Persons who may give offense because of disease, who are drunk, or whose clothes are offensive, are not admitted. This rule applies also to dogs, other animals, and luggage, which, on account of bulkiness, smell, or unclean condition, may annoy the passengers.

The following particulars relate especially to one of the two companies in Christiania (*Kristiania sporveisselskap*):

Construction of cars.—The framework of the car is constructed of wood with side plates of iron or aluminum. The compartment has two window panes on each side, nearly 2 meters long, and a smaller window between to be pulled down for ventilation. In addition, there are under the roof skylights with shutters. Each compartment will seat 20 adults. At both ends there are sliding doors. The platforms of the motor cars are built in, and have tight-shutting side doors, one of which is always open. In the summer trailers, wholly or partly open, are used.

The lighting of the compartment is effected by six incandescent lamps of 16 candlepower each. The heating is done partly by coal-brick fire under the seats, partly by brake currents from the motors. For preventing drafts in winter felt is hung before the lower half of the window panes. Formerly in winter the seats were covered with plush carpet, but for sanitary reasons this has been removed. Similarly the coco rugs that formerly were laid on the floorings have been abolished. The cars are washed thoroughly every night.

Sanitation of stations.—All the stations—that is, car stations (there are no stations on the stopping places)—are overground. They have washing, dining, and bath rooms for the employees.

Prevention of accidents.—The cars have two sets of brakes—mechanical and electric—and mechanical sanding apparatus. The under part of the car is wholly surrounded by a plowlike frame. The company has experimented to a considerable extent with home and foreign inventions for preventing accidents without having as yet obtained permission from the municipal authorities to adopt a new system.

In the main station there is a motor car provided with implements for repairing the lines and the working stock. It is also ready to assist in case of accidents, e. g., to lift the cars if anyone has been run over.

Education of employees.—Those applying for employment on the cars have first to pass through a practical course of driving or conducting under the guidance of a skilled officer especially fitted for

that work. Thereupon they are put in the reserve, and after having been in service there for some time they are eligible for regular employment.

Everyone who is employed on cars is medically examined before engagement. No one without unimpeachable health is engaged.

The regular employees are members of the sick and relief fund and of the widows', orphans', and old-age fund of the company.

In the winter the employees are provided with fur clothes, thick sealskin boots, and fur cap; in the summer, with light summer clothes and cap. They have 8½ hours' daily work, in two shifts. They are free from duty every eleventh week day and every fourth Sunday; besides this, they have 14 days' holiday with pay in the summer.

Sanitary control of passengers.—In addition to the above-mentioned restrictions as to diseased persons and bulky, evil-smelling, or unclean luggage, there are prohibitions against smoking in the compartment. Spitters on the floorings are liable to expulsion.

RAILWAY TRAFFIC.

In Norway railways can not be constructed without permission from the Government. The great majority of the railways (in 1911, 2,614 kilometers) are owned by the State. The total length of private railways in 1911 was 476 kilometers.

The following details relate to regulations and measures concerning State railways:

Sanitation of stations.—In all stations the floorings shall be washed daily, and tables, benches, etc., dusted daily. In the waiting rooms there shall be a sufficient number of spittoons, and placards prohibiting spitting on floorings shall be put up on the walls. The yard before the station shall be cleaned daily of horse droppings and other offal. Manure wagons shall be unloaded and the contents carried off by the consignee as soon as possible. The manure pits shall be strewn with slaked lime. The urinals shall be flushed with water and irrigated with a solution of carbolic acid. The cesspools shall be emptied and cleaned as often as is necessary to avoid overfilling.

Construction of cars.—The type of car is not very different from that commonly found in Europe. Norway has joined the third international convention (in Bern, May 18, 1907) on standardizing the technical outfittings of railways. All rolling stock shall be on springs and have elastic buffers. Passenger cars shall be examined and repaired at least every sixth month. The compartments, as a rule, have ventilation—skylights. In the summer season the car shall be thoroughly ventilated by opening the windows on both sides for half an hour before departure from stations. The cars are generally heated by steam and lighted by petroleum lamps or electricity; of

late years gas has been used more and more. Passenger cars shall be kept thoroughly clean inside and outside. There shall be in every compartment two movable spittoons and a placard prohibiting spitting on floorings. If a person suffering from infectious disease has been conveyed in the car, the latter, on arrival at the station of destination, shall be taken from the train and disinfected. Detailed directions are given for the disinfection of cars which have conveyed persons infected with cholera. Freight cars also shall be kept properly clean. The station masters shall see especially that cars which have recently transported petroleum, fertilizers in packing, cattle bones, acids, etc., are thoroughly cleaned and swept before being used to transport merchandise that may be damaged (e. g., meal and corn). The cleaning shall always take place immediately after the unloading of the wagon. Detailed directions are given for the cleaning and disinfection of wagons which have transported cattle.

Safety devices.—Owing to the somewhat simple and uncomplicated conditions and to thorough care, accidents on the railways in Norway are very rare. Probably there are few countries that can show so low a percentage of accidents. Signaling on the lines and at the stations is effected by manual signals (flags of red, green, and white cloth, lamps, whistles, horns, and explosive signals) and by fixed signal apparatus (semaphores, disks, block signals, marks for road crossings, and station limits). On trains the above-mentioned manual signals, steam whistles, and lanterns are employed.

Hygiene of employees.—Before any person is given regular engagement he shall produce a certificate from a physician stating that he is suffering from no disease or other defect that might reduce his fitness for duty and that he has a normal color sense. He shall also produce from his former employers a special testimonial of sobriety; such testimonial is also required for subsequent employment or promotion in the safety service. No one who is under 18 years of age or who has suffered from mental diseases is employed in the safety service, the telegraph, or as pointsman or guardian of the line. It is strictly prohibited to carry or consume intoxicating drinks when on duty. Employees are also prohibited from acting as intermediaries in the purchase of spirits. The men are not allowed to smoke when on duty. The hours of labor vary from 50 to 65 weekly. Employees are generally free every third Sunday. They can also be granted 14 days holiday (under special circumstances up to 30 days), all the while drawing their wages. The railway provides housing accommodation for a comparatively low payment for station masters and some of the guardians of the line. In some cases it provides free lodging for trainmen who are obliged to spend the night away from home.

If any one of the regular men is taken ill, the railway grants him exemption from duty up to the end of six consecutive months. Those who are not regularly employed, and who have a yearly income of under 1,400 kroner, in towns (or under 1,200 kroner in the country), have free medical assistance and sick pay in accordance with the act of sick insurance of 1909.

If any one of the regular force is injured on duty, the railway pays for free medical assistance and medicine (or care in hospital) and full wages as long as he is unfit for work, not exceeding, however, 12 months. At the expiration of this period, if he is still unfit for work, he obtains a pension. If the accident has resulted in death, the railway pays the funeral expenses, full wages for six months after the decease, and thereafter a pension to widow and children. If anyone who is not regularly employed is injured on duty the railway pays for free medical assistance and allows him sick pay as long as he is unfit for work. Should the accident result in death, the railway pays the funeral expenses up to an amount of 50 kroner and an annuity to his family.

For the regular men a pension fund has been instituted which gives a pension to those who are discharged after having attained the age of 65. There is also a widows' fund and a relief fund.

Food, water, and ice supplies.—Drinking water, mixed with ice in the warm season, shall be at hand in all stations and passenger trains. There are lavatories in most of the passenger cars. Long-distance trains as a rule have dining cars, and there are restaurants in the larger stations.

Accident relief.—If anyone is injured, the railway has to provide for medical assistance as soon as possible. Should the physician or the hospital demand security for fees or expenses, such security shall be given for provisional treatment or care so that the railway can be said to have done its best to provide immediate help.

At several of the larger stations there is a stretcher and an ambulance chest containing medicine, bandages, etc.

For the transport of the sick there are in several districts one or more sick cars. These as a rule are stationed at one of the head stations, from which they can be ordered as occasion requires. For the establishment, if possible, of a system with sick compartments in the trains an arrangement will be put on trial whereby one of the compartments in the middle of a third-class bogie car can be so transformed that it will give ample accommodation to an invalid basket. The compartments have no special outfit for sick transport and are employed as regular passenger compartments. To complete this arrangement some stretchers are being procured by means of which the patient may be lifted into the compartment through one

of the side windows. The stretchers are provided with straps so that they can be hung upon the brackets of the racks.

Sanitary supervision of passengers.—Persons that may inconvenience or annoy the passengers because of illness or mental or physical defects are not allowed in the trains without special permission. The railway employees shall strictly control the nonadmission to the trains of intoxicated persons. Should such persons obtain admission they may be put down underway. Besides this they may be prosecuted, the penal law prohibiting anyone being drunk on public conveyances. Persons spitting without using the spittoons can be ordered out.

Hygiene of merchandise.—Goods that by leaking or otherwise may damage other merchandise shall be loaded on special cars, if possible, or at any rate be kept isolated. Merchandise that may be damaged by wet or kindled by sparks from the engine shall be covered by tarpaulins, tied fast, or transported in covered cars.

All perishable goods shall be dealt with carefully and not be loaded so as to be damaged while under way, e. g., by odor. Thus butter, milk, and the like victuals shall not be loaded with fresh fish, for instance. For the transport of foods that are likely to be damaged by heat or by cold special refrigerating and heating cars have been built. As these are especially designed for transportation of fresh meat, fish, and milk, for cleanliness the floorings are specially covered.

In accordance with the act of May 3, 1871, detailed regulations are enacted for the transport of certain explosive and inflammable substances. These regulations require, amongst other things, special notice; transport by special trains, when there is more than a certain quantity; special packing; and a special staff for supervision.

Prevention of spread of infectious diseases.—Before sick persons are received for transport a medical certificate shall be produced, in which a physician shall specify whether the disease is infectious. Persons suffering from plague shall not be received for transport. Persons suffering from other infectious diseases can be received for transport in sick cars or in covered cars, but special permission from the traffic manager shall be procured in every case. If the disease is cholera, yellow fever, smallpox, dysentery, or typhoid, a declaration from the chairman of the local board of health shall be procured, stating that the transport is necessary or desirable and how far special measures shall be taken for the transport or the subsequent disinfection. The car shall be attached behind the other passenger cars in the train. The installation and removal of the sick shall take place at least half an hour before and after the other passengers mount or alight and in such manner that the sick and his attendants do not come into contact with the station buildings and

the passenger platforms. In the transport of persons suffering from cholera, yellow fever, etc., the attendants of the sick shall declare their names and addresses to the master of the station of departure, who gives notice to the master at the station of arrival. The attendants shall also produce a medical certificate stating that their transport can proceed without risk of infection. Corpses of persons who have died of infectious diseases are not received for transport without a special permit. They shall be put into an air-tight coffin of zinc or other metal. Cattle suffering from infectious diseases are not received for transport.

In accordance with the act of June 17, 1909, persons arriving at Norway from places infected with cholera or plague and not having left the infected place at least five days before the outbreak of the epidemic, shall report themselves to the chairman of the local board of health, and give name, occupation, home, place of destination, traveling plans, and date of departure from the infected place. They are then bound to present themselves for daily inspection for five days, counting from the day of departure from the infected place.

In times when there is special danger of importation of cholera the railway board can enforce stricter regulations for the control and isolation of persons with cholera-like symptoms, disinfection of luggage and compartments, precautions as to car closets and thorough cleansing of stations. Nurses and invalid equipment may also be sent in the trains.

LAKE AND RIVER TRAFFIC.

Apart from some greater lakes, the waterways of Norway are only to a relatively small extent naturally available for navigation, nor are there many places where there has been a possibility of artificial improvements. The length of the navigable waterways is therefore not considerable in proportion to the area of the country.

Protection and lighting of waterways.—Marks and signs, consisting, as a rule, of anchored logs, have been put in many places to mark the fairway. In one canal screens—some of wood, others of stone—have been built up to protect the draft against the backwash. Beyond this it has not been considered necessary to make special works for protecting the waterways. Most of them are used during the day only. Lighting is therefore not necessary. Some parts, however, especially dangerous for traffic, are lighted by lamps in the dark season.

Prevention of pollution of waters.—According to the generally accepted views, which, however, have of late years been contested, the water in rivers and minor lakes is subject to private ownership. The persons over whose ground the water runs have a right to dispose of it subject to the restrictions made by legislation. In this

respect it is noteworthy that owners of industrial plants have to prevent such offal from being led into the watercourse as would inconvenience others interested in the waterway. Pollution shall not take place to an extent to cause "extraordinary or unforeseen" inconveniences to owners of rights on lower reaches of the watercourse. If the latter desire to prevent pollution beyond this limit, they may petition the Government to expropriate or lay an easement on the properties in question bordering on the waterway. Further, in this connection, it may be observed that local boards of health may have rather limited prohibitions against pollution of water, especially drinking water, inserted in the sanitary by-laws.

Hygiene of water craft.—The seaworthiness act of 1903 may also be applied to ships engaged in lake and river traffic. Regarding life-saving appliances, the royal ordinance of May 1, 1909, decides that the ships shall have a lifeboat, life buoys, and life belts. A royal ordinance of May 22, 1906, has enacted regulations regarding the construction of rails, stairs, ladders, gangways, cranes, steam winches, open hatches, etc. It provides also against fires.

Examination and care of employees.—The provisions for examination and care of employees, enacted by the maritime act of 1893 and the seaworthiness act of 1903, have little reference to ships engaged in lake and river traffic. The crews of steamships of over 15 registered tons and of sailing ships of over 50 registered tons are provided for in the act of accident insurance for seamen of 1911.

Sanitary supervision of passengers.—As to sanitary supervision of passengers, there are no special rules apart from the common legislation regarding the public health. In accordance with this local boards of health are empowered to fix the measures which they deem necessary for preventing the spread of infectious diseases, each board being responsible for its respective district; also for lake and river traffic within that district.

SEA TRAFFIC.

In accordance with the act of public health of May 16, 1860, every town or district can make sanitary by-laws, subject to the approval of the Government. In these may be inserted regulations concerning sanitary conditions in the ports. The by-laws are administered by the local board of health consisting, in towns, of the medical officer of health, the magistrate, the commissioner of public works, and three other members elected by the town council.

Harbor sanitary regulations.—The ports act of July 10, 1894, contains also some regulations concerning the public health. Ships are prohibited, without special permission, from polluting the harbors and their surroundings by throwing overboard refuse and offal. The

municipal authorities are to make regulations for the use of fire and light in port, and the port authorities may publish special regulations on the loading and unloading of explosives and inflammable substances.

Provisions for life saving.—While the other countries bordering on the North Sea, especially England and Denmark, had long ago organized life-saving stations, with staff and apparatus, Norway was lacking in such establishments until about 1890. Our steep and precipitous coasts, surrounded by cliffs and shoals, put obstacles in the way of the establishment of fixed stations with lifeboats and rocket apparatus. It was not until somewhat after 1880 that the idea of floating stations—that is, small steam or sailing craft, the chief task of which would be to prevent wreckage—began to gain ground. On this principle the Norwegian Society for the Saving of Shipwrecks was established. It is supported by private subscriptions, the State, however, contributing a yearly amount of about 25,000 kroner. The society now possesses 20 life-saving boats, all sailing boats, as these have proved superior to steamboats in strong gales and heavy seas. They are strong, solid craft, able to withstand the roughest storms. They are stationed, during certain months of the year, each on its respective field of operation. Their main work consists in towing fishing boats that are not able to get in during gales off the coast. They can easily beat up to land when towing from 4 to 5 fishing boats. A single lifeboat has towed 12 fishing boats in a strong gale. Besides this, they assist ships that have gotten into narrow and perilous waters without a pilot or that are otherwise in distress. They have also often been used to fetch a medical man, midwife, or clergyman when a steamboat has not been at hand and the sea has been too rough for ordinary boats. In case of wreckage the district officials of the society are empowered to make the arrangements which they deem necessary, the expenses within a certain limit being covered by the society.

Another association, the Norwegian Life Saving Society, has set itself the task of instructing people, especially school children, to swim and of propagating the elementary rules for rescuing drowning persons. It has taken up the task of introducing swimming as an obligatory school subject. It is supported by private subscriptions and a yearly contribution from the State.

Hygiene of ships.—The legislation of Norway contains many provisions for the construction, arrangement, and equipment of ships. The chief act is that concerning the public supervision of the seaworthiness of ships of June 9, 1903 (with amendments of Sept. 18, 1909). The supervision is undertaken by the State.

In accordance with this act the Government has issued directions for life-saving appliances on ships (royal ordinance of May 1, 1909).

Ships, not conveying passengers, shall have boats of such size and in such number as will provide boat room of 20 cubic feet for each of the crew. They shall have up to four life buoys, in all, and one life belt for each person on board. On ships trading outside Norway and having a crew of at least 10 persons, the boats shall be lifeboats; if the crew is under 10 the ships shall carry floating appliances. The same applies to ships on inland trade. Passenger ships plying between Europe and foreign continents shall have boats in davits of size and number sufficient to contain at least four-tenths of the number of persons that the ship is allowed to convey, and other boats, life-saving globes, and approved appliances of size and number sufficient to contain the rest of the persons on board. These ships shall also have eight life buoys if the number of persons allowed is not above 100, and one life buoy extra for each additional 100 or part thereof. Besides this, there shall be as many life belts as the number of passengers allowed. Two-thirds of the boats in davits shall be lifeboats and one-third boats with floating appliances. In the davits, however, there shall always be at least four lifeboats and two boats with floating appliances, gauging at least 1,200 cubic feet. On passenger ships for trade in Europe and for inland coast trade the number and size of boats and the number of life buoys may be less. The Government has given detailed regulations for the construction and placement of boats, buoys, and belts.

The aforementioned regulations apply to sailing ships of over 50 registered tons and steamships of over 25 registered tons. Ships under this size shall have one boat, one life buoy, and one life belt for each person on board.

The crew is bound to practice (on passenger ships, once a month, and on other ships, once every second month) the setting out of all the boats, so as to be sure that everything is in order.

All ships engaged in trade outside Norway and ships trading beyond 7½ miles off the coast shall be provided with tanks for the spreading of oil on the sea.

For the security and safeguard of persons on board the act of 1903 provides in general terms that a ship shall have such devices and arrangements as it is possible to make, considering its size and speed. The act empowers the Government to give closer details, and this is done by the royal ordinance of May 22, 1906. This ordinance enacts regulations regarding the construction of rails, stairs, ladders, gangways, cranes, steam winches, open hatches, etc. It provides against fires and—in tropical seas—lightning, and against accidents when anyone of the crew may work on the outside of the ship. It orders awnings, in certain cases, and safety lamps for working in floor tanks, which have been closed for a long time. Regarding berths (cabins) the act decides that in ships gauging over 200 reg-

istered tons every room destined for sleeping accommodation for the crew shall have a minimum surface of 17 square feet and a contents of 120 cubic feet per man. Each of the crew shall have his own bunk measuring at least 1.90 by 0.60 meters. Over the doors shall be distinct inscriptions or marks indicating the number of persons for whom the room is intended. On sailing ships of over 50 registered tons and on steamships of over 25 registered tons not more than two bunks may be placed one above the other.

Moreover, there are detailed regulations concerning the arrangement of bunks, and the washing, ventilation, and lighting of berths. The rooms shall be washed and cleaned from top to bottom three or four times a year; in addition to this, a thorough washing and disinfection shall be given them after cases of contagious disease. Every ship of over 100 registered tons shall be provided with one or more properly constructed and ventilated closets, which shall be cleaned daily. Ships without closets shall have closet buckets. Steamships built after the enforcement of the act and destined for long voyages or tropical seas shall have a bathroom. Ships with a crew of 12 persons or more shall have a special sick room with 1 bunk, if the crew is 12 to 17 in number; 2 bunks, if it is 18 to 30; 3 bunks, if it is 31 to 45; and 4 bunks, if the crew is 46 or more. Such a sick room is not obligatory for fishing and whaling boats under 200 registered tons nor for ships in the coasting trade and those running regularly in European seas if they are expected not to be at sea for a longer time usually than three days. A royal ordinance of October 6, 1909, gives detailed regulations for protecting the health and security of the engine-room staff. A royal ordinance of August 27, 1909, gives special regulations for ships conveying passengers. Ships trading between Europe and foreign continents shall have a physician if there are more than 100 persons on board. If there are more than 1,200 persons there shall also be an assistant physician. Before departure both passengers and crew shall be medically examined.

Detailed regulations are given for the construction of berths and for the construction, cleaning, and lighting of cabins. Apart from the closets designed for the crew, there shall be at least 2 closets, 1 for men and 1 for women, distant from each other as far as possible, preferably on either side of the ship. If the ship conveys more than 50 passengers there shall be, in addition, 1 closet for every 50 women and 1 for every 100 men. The closets shall be separated from passenger rooms by a closed bulkhead. Floorings, walls, and ceilings shall be impermeable. The closets shall be properly ventilated and lighted and of such construction that they can be swilled out. There shall be special sick rooms for the passengers, and a dispensary that may also be used for operations. Near the

sick room there shall be 1 bathroom and 2 closets with irrigation apparatus. There shall be 2 lavatories, 1 for men and 1 for women, to be used by the passengers only. Such rooms are not compulsory if the passengers have cabins with at least one washstand for every 6 persons. Ships going to ports south of 30° N. shall have a bath arrangement for every 50 passengers (apart from the bath belonging to the sick room). If the ship conveys more than 100 persons it shall have a wireless installation, approved by the Government. For passenger ships trading in European seas the foregoing provisions are modified. For passenger ships on coasting trade the following provisions only are obligatory: There shall be 2 light and properly ventilated closets with irrigation apparatus, and 1 additional closet for every 100 passengers over 50.

A royal ordinance of July 21, 1894 (with amendments of October 12, 1895, and March 27, 1897), provides for the supply of medicine on ships. Every ship of over 100 registered tons trading outside Norway or in the Arctic seas shall have a book on medicine, authorized by the Government, and a medicine chest containing certain drugs, instruments, and bandages. These ships, except those trading in Europe north of Cape Finisterre, shall also carry invalid's food (wheat biscuits, sago or tapioca, oatmeal, eggs, condensed milk, meat extract, wine, whisky or cognac, canned vegetables, cocoa). The master before departure shall see that medicine and invalid's food are in good condition and sufficient in quantity. In case of any considerable consumption during the voyage, a new supply shall be taken aboard at the first opportunity. At least once a year the master shall have the contents of the medicine chest examined by a competent person, so that drugs which are damaged or have lost their efficiency may be replaced by new ones.

The act of 1903 empowers the Government to regulate food and water supplies on ships. Such regulations are enacted by a royal ordinance of November 24, 1905. They apply to ships trading outside Europe and to ships on inland trade if destined to be more than 14 days at sea, and only to sailing ships of over 50 registered tons and steamships of over 25 registered tons.

On ships carrying coolies a special dietary may be established for that part of the crew. The regulations contain a food list to be put up in the forecastle, indicating the quantity of each man's daily rations. The ship shall be provided with the kinds of victuals ordered, in such quantity that the members of the crew may have their rations, even though the voyage may last longer than usual. On ships trading south of 33° N., and destined to make over 30 days' voyage, the master before departure shall have all victuals and water examined and he shall see that they are in the condition

required, whereof closer details are given in the regulations. For voyages north of 33° N. the master shall observe the demands of custom concerning good and wholesome victuals; there is no prohibition against unguaranteed preserved foods on these voyages. The drinking water shall preferably be placed in iron tanks (in tropical seas in such tanks only), which are cemented or lime washed inside and thoroughly clean. If wood tanks are used, they shall always be kept carefully clean, and from time to time be washed with unslaked lime and water. The water shall be taken from public waterworks, if there be an opportunity for that. It must not be taken from rivers in port towns unless water from another source is not obtainable. Bad water shall be boiled before being used for drinking purposes; also all water taken in tropical seas or in ports which are infected with yellow fever, cholera, dysentery, beriberi, or typhus diseases, unless the sanitary authorities or the Norwegian consul certify that the water is considered free from infection. To boiled drinking water shall be added some tea, oatmeal, lime juice, or drinking salt. During the voyage the provisions shall be frequently inspected. At least once in every second month the master or one of the mates, in conjunction with the steward and one of the crew, shall undertake a thorough inspection of all provisions and water. Should any case of sickness occur during the voyage, supposed to be derived from the victuals or from the water, and feared to involve serious consequences, the ship shall touch at a port for supplies of fresh victuals and water, and, if the physician deems it necessary, debark the sick persons. Under such circumstances, the master of the ship shall hold a sea council before decision is taken. In all cases of sickness which seem to originate from victuals, and in all cases of scurvy or the appearance of beriberilike symptoms the master shall make a maritime declaration before the Norwegian consul at the first port of call. The regulations contain, finally, some details regarding the weekly dietary, and some measures for preventing diseases connected with victuals, e. g., distribution every day of two tablespoons of lime juice to each person on board when the supply of fresh potatoes has run short or is damaged or when beriberi or scorbutic cases occur.

Examination and care of employees.—In accordance with the act of 1903, no person who has not attained the age of 17 years shall be engaged as stoker or coal trimmer on ships for trade outside Norway. Every person who wishes employment on deck shall produce a certificate from a qualified physician, stating that the applicant is able to discriminate between the colors ordered for signal lanterns, and that he does not suffer from any other deficiency in sight or in hearing. Such certificate is also required from candidates for the post of captain or mate. The physician shall test the color sense

in full daylight by one of several methods that are further described. He shall also test the hearing by determining if whispering is distinguished at a distance of 3 meters.

Any person on being engaged in Norway for service on board a ship for trade beyond Europe shall produce a certificate from a qualified physician stating that he does not suffer from any malignant infectious disease (including tuberculosis) of such a character that conveyance of the disease to others may be apprehended. Such certificate should be made out within a fortnight before signing articles. On being engaged in Norway for service in a ship for European trade, and always on engaging abroad, the seaman shall declare, before the engaging officer, that he does not, to the best of his knowledge and belief, suffer from any of the diseases above mentioned. If while employed on board there is reason to suppose that any member of the crew suffers from such a disease, the master shall cause a medical examination to be held as soon as possible. If disease is found, unless the necessary treatment for counteracting the spread of the disease can be given on board, the master shall discharge the patient. When a patient is discharged in pursuance of this clause the same rules which are now prescribed by articles 90 and 98 of the maritime act shall apply in respect to his right of wages, treatment, and conveyance home. The requirement for certificate concerning malignant infectious diseases does not apply to the master, because, as a rule, he lives rather apart from the rest of the crew. Neither such certificate nor certificate for color sense and hearing applies to ships on local trade in Norwegian waters.

The maritime act of 1893 and the seaworthiness act of 1903 contain several injunctions to the master of the ship respecting the abuse of his power. He is not allowed to administer corporeal punishment. On Sundays, if possible, he shall hold services on board and not charge anyone with work apart from what is necessary for the security and handling of the ship. He shall see that the crew obtain sufficient rest, and that the hours of labor, which ordinarily shall conform to the usual practice, do not, except in emergency, exceed 18. In tropical seas, during the warm season, the hours of loading and unloading shall not extend to 8 hours per day. If the working hours exceed certain limits, the crew have a right to additional wages.

If a violent epidemic of cholera, yellow fever, or plague should break out in a port for which the ship is bound, the crew have the right to receive a discharge at once, if the voyage has not begun; otherwise, in the first port touched by the ship after the crew have been made cognizant of the epidemic.

If any member of the crew is taken ill or injured, the master, according to article 90 of the maritime act, shall provide for due care on board or ashore. But if he is unable to do his work for a con-

siderable time, or if he is suffering from syphilis, he may be discharged at once. If this discharge takes places abroad, the master shall consign him to the consul, or, if there is no consul in the port, otherwise provide for the patient's proper care. For the payment of hire in case of discharge and the bearing of expenses for the sick's care and return to his home detailed rules are laid down.

An act of accident insurance for seamen (the master included) was enacted in the year 1911. It applies to sailing ships of over 50 registered tons and to steamships of over 15 registered tons. The scope of the act is indemnification in case of (1) accidents involving injuries or death, (2) death caused directly by climate or by epidemic diseases (scurvy and beriberi included). In case of injuries, the injured party obtains an annuity up to 60 per cent of his wages (according as the invalidity may be total or partial). If it is necessary to place him in a hospital, he is cared for and treated gratuitously there. When in the hospital, his wife and family have a right to the same indemnity as in case of death. In the latter event the insurance pays the funeral expenses and an annuity to the family (wife, 20 per cent; children under 15 years of age, 15 per cent; parents and grandparents who have been supported by the deceased, 20 per cent, of the wages). The premium is chargeable to the shipowners.

Supervision of passengers.—The control to which the passengers, as well as the crew, are subject, in view of preventing importation of infectious diseases, will be mentioned in the discussion of maritime quarantine.

As already said, on ships conveying passengers between Europe and foreign continents, the master shall produce before departure a certificate to the effect that crew and passengers have been medically examined.

For the protection of Norwegian emigrants against the inconveniences to which they were formerly subject under the transport to America, especially because of the overcrowding of ships, in about 1860 the Government enacted regulations for the number of passengers allowed on ships. As long as the emigration was conducted on ships sailing directly to America—and it was practically always so at that time—these regulations proved sufficient. But, as the emigration increased, and agents for foreign companies, undertaking the transport of emigrants to their place of destination in the interior of America, established themselves in Norway, many complaints arose over irregularities on their part, whereby the emigrants were greatly inconvenienced. These complaints were of so serious a nature that the intervention of the Parliament was required, and the act of May 22, 1869 (with amendments of June 5, 1897), was passed. The scope of this act is mainly to control the

emigration agents. It decides that no one shall act as such agent without permission from the police. Before being given such permission, an agent is required to find security to an amount of 8,000 to 28,000 kroner. This amount is security for all the obligations the agent might incur toward the emigrant or by infringements of the act. He shall make a written contract with every emigrant, containing an exact and detailed statement of the terms, especially (*a*) in what way and to what place the emigrant and his luggage shall be transported; (*b*) whether the agent shall undertake any special obligation as to the board and lodging of the emigrant, if the ship be delayed; or to his conveyance, if it be wrecked or unable to continue the voyage; (*c*) what the emigrant has paid or shall pay.

Any clause to the effect that the emigrant shall pay his passage by work after having arrived at the foreign continent is void and entails fines for the agent. The contract shall be shown to the police and, provided with their signature, delivered to the emigrant. If the latter has any complaint to make of nonfulfillment of the contract, he shall immediately give notice to the nearest consul, who shall make the necessary arrangements. If the consul can not adjust the affair by way of compromise, he shall make a report to the Government, which shall settle the affair with binding effect upon the agent in question.

With regard to immigration, anyone, not a Norwegian subject, who desires to settle down in the country, shall, on his arrival, give notice to the police, who can order him to present himself. The police examine his papers of legitimation and investigate if he possesses sufficient means to sustain life, or is likely to earn his livelihood in a legitimate way. The police can order him out of the country (1) if he has not given notice of his arrival, (2) if he can not furnish sufficient information concerning his economic position or his chances of obtaining work, and (3) if he is given to idleness under such circumstances that there are reasons for supposing that he supports himself wholly or partly by illegitimate means.

Supervision of cargoes.—The act of 1903 decides that ships—except those under 100 registered tons and those trading outside Norway—shall be provided with a Plimsoll's mark, and that the ship shall not take on so much cargo that this mark be invisible over the surface of the water. To carry deck cargo, the ship shall be so constructed that this can be done without special danger. The act gives detailed directions for the loading of corn with the object of preventing shifting of the cargo. If coal or other gas-containing substances are loaded, surface ventilation shall be established to such extent as to provide free outlet for explosive gases. On ships trading outside Norway there shall be two ventilation pipes to every stowage room; for a room which will contain more than 1,500 tons there shall be

three pipes. There are detailed regulations for the size, quality, and placement of such pipes. Explosive substances shall be stowed in locked rooms, under deck, at a safe distance from engine rooms, stoves, etc. When stowed in the same room with other cargo they shall be separated from these by proper trimming. The packing shall be marked "explosive." Corrosive substances, e. g., sulphuric, muriatic, and nitric acid, shall not be stowed under deck, unless sufficient quantities of pulverous and porous mineral substances, sand, earth, or the like, prevent leaking fluids from coming into contact with any part of the ship. Substances especially inflammable, e. g., ether, naphtha, gasoil, or benzine, shall, on passenger ships, be placed on deck and in strong tanks. If, on other ships, they are stowed under deck, either the ship shall be constructed as a tank ship, or the fluids shall be put into strong, gas-tight tanks, scrupulously protected; then all cabins for the crew shall be placed on the top deck. Such fluids shall not be put in glass carboys, unless these are wrapped in straw or the like loose materials and tightly packed in waterproof boxes or tubs, provided with ears, whereby the carboys may be protected from above. Such carboys shall not be placed one above the other. The Government has enacted detailed regulations for the transport on ships of such inflammable fluids. (Royal Ordinance of Aug. 7, 1906, and Sept. 16, 1908.) Other less inflammable fluids, e. g., alcohol, turpentine, petroleum, and paraffin oil, when stowed under deck, shall be properly isolated from engine rooms and stoves. Gases compressed in steel cylinders (like liquid carbonic acid) shall be stowed in closed rooms that are at a horizontal distance of at least 2 meters from engine rooms.

Maritime quarantine.—Until some years ago quarantine was to a great extent employed as a means of preventing the importation of infectious diseases. The act of June 17, 1909 (with regulations of Nov. 17, 1909), abolished the quarantine system and adopted the modern inspection system. The act has abolished the former quarantine commissions and transferred their authority to the local boards of health.

The chairman of the board (the medical officer of health) is empowered to go on board every vessel arriving at or anchored in a Norwegian port in order to inspect the sanitary conditions of the ship. If the vessel has come from abroad, the master shall deliver on his honor and conscience a declaration of the state of health on board. If any case of infectious disease has occurred, it is required that the permission of the chairman shall be obtained (1) to convey the sick or dead, or any objects used by them, from the vessel; (2) for persons who have been in the same room as the sick or have come into contact with them to leave the vessel; (3) for the vessel to have free intercourse with land or with other vessels. Should any case

of infectious disease appear on the vessel during its stay in the port the master is bound to give information thereof to the chairman as soon as possible.

SPECIAL MEASURES AGAINST PLAGUE, CHOLERA, AND SMALLPOX.

The act (with regulations) of 1909 is founded on the principles adopted by the Paris convention of December 3, 1903, and the regulations have been kept entirely within the limits of this convention.

Cholera.—Uninfected ships coming from an infected port and having made a voyage of more than five days shall be disinfected, if necessary, whereupon the ship is free to go where she will. If the voyage has been shorter than five days, disinfection shall take place, if necessary, and crew and passengers, whether remaining on board or leaving the ship, shall be under supervision for five days, counting from the day of departure from the infected port. At the expiration of this period the ship shall go free.

Suspected ships are subject to the same regulations, with the exception, however, that the period of supervision of five days is counted from the day of arrival.

On infected ships the sick shall be isolated, corpses buried in a satisfactory manner, necessary disinfection made, and the persons on board who are not sick shall be isolated for five days, counting from the day of arrival. The chairman, however, can allow persons who have not been exposed to infection to leave the ship at once on declaring their name, occupation, home, place of destination, present address, and traveling plans and on signing an obligation to present themselves for daily inspection for five days, counting from the day of arrival. If isolation of the sick can not be made in the port of arrival, or if the master will not pay the expenses involved, the ship shall be directed to a sanitary station (in Tromsoe or in Kristianssand).

Plague.—Uninfected and suspected ships are, on the whole, subject to the same measures as in the case of cholera, with the additional provision, however, that rats on board shall be exterminated. Infected ships also are subject to the same rules, with the additional provision that rats shall be exterminated and that the persons on board who are not sick, after having been isolated for five days, shall be under daily supervision for the following five days. The chairman can allow persons who have not been exposed to infection to leave the ship at once after declaring their names and signing an obligation to present themselves for daily inspection for 10 days, counting from the day of arrival. If isolation of the sick can not be accomplished in the port of arrival, or if the master will not pay the expenses thereof, the ship shall be directed to a sanitary station.

Smallpox.—If the ship, on arrival at a Norwegian port, neither has had nor has any case of smallpox on board, it is set free. Persons on board are vaccinated or revaccinated, if the chairman deems it necessary. If it has had or has any case on board, the sick are isolated, corpses are properly buried, necessary disinfection is made, and the persons on board, whether leaving the ship or not, remain under supervision for 14 days after the disinfection of the vessel. Persons not having had smallpox are vaccinated or revaccinated.

All ships can obtain permission from the chairman to continue the voyage, even though the period of inspection has not expired. They are, however, under the control of the local boards of health in the ports at which they may touch during the period of inspection.

Ships that are not willing to subject themselves to be above-mentioned measures are free to go to sea again.

In the case of persons who are ordered to present themselves for inspection after having left the ship, the chairman of the local board of health shall send a list of these persons to the local government board, cause them to sign an obligation to present themselves for inspection, deliver to each of them a card of identification, and give notice to the chairman of that place or those places which the person has declared as his places of destination or residence. These persons are then obliged to present themselves for inspection at the time and place designated by the chairman in question. The card of identification is indorsed at each inspection, and at the expiration of the period of inspection is sent to the local government board.

In accordance with the Paris Convention, two sanitary stations have been established, one in Tromsoe and one in Kristianssand.

International sanitary relations.—Norway has joined the Paris Convention of December 3, 1903, with amendments of January 17, 1912.

THE TREATMENT OF RAILWAY EMPLOYEES IN HOLLAND.

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There is no province within the scope of hygienic science which is more difficult in practice than the hygiene of railway traffic.

In railway travel dangers threaten the traveler from: First, the track, with its buildings; second, the rolling stock; and, third, fellow passengers and railway men. The first two of this category may be passed by, because the conditions with regard to them are about the same in Holland as in other countries of Europe. In Holland all the railways, including those built by the State, are managed by private companies, who are required by contract with the State to see to it

that the speed, safety, quality, comfort, and sanitary conditions of rolling stock and the conditions of stations and other buildings are maintained in the highest degree. The Dutch railway system compares favorably with that of the best-managed European lines, while the latest improvements are applied when possible.

A State council of survey, with a staff of officials, take care that the railway companies observe the regulations of the Government and the State contracts. With regard to the technical requirements of track, buildings, rolling stock, and prevention of accidents, the Dutch railways may compete with the best abroad. At present Germany is ahead of us only in one particular, as the result of a recent provision, whereby a whole railway carriage can be disinfected at once. Nevertheless, however excellent a line may be in the condition of track, rolling stock, and the latest improvements for the safety and comfort of passengers, all these are insufficient defenses against other dangers, so long as the quality of the employees is not as good as that of the material. I consider that expert and willing railway men, even when working with a plant of inferior quality, will take better care of the traveling public than an undeveloped and indifferent staff using the best material.

In the first place, the employees must be mentally and physically competent for their positions; and, secondly, they must be contented in their duties, so that they will perform their work punctually and agreeably. Perfection, of course, can not be attained, for a certain number of the men will be found deficient in skill and mental equipment.

In Holland only craftsmen and ordinary laborers are exempt from passing an examination to get employment on the railways. All aspirants must undergo a rather severe medical examination, different conditions being applicable to the separate branches, and special care taken to ascertain that sight and hearing are good. Under ordinary circumstances the sight is reexamined at the end of the forty-fifth year, and afterwards every five years until the sixtieth year is reached. The eyes are examined after each illness that might have a detrimental influence on the visual organ. Above 65 no one is permitted to remain in service. Provision is made for any official who becomes unfit for his post, though able to perform a less responsible kind of work. He is transferred without reduction in wages. By this treatment it is possible to discover much sooner persons suffering from certain diseases, as epilepsy, heart affections, etc., and have them relieved from important duties and assigned to tasks suitable to their state of health.

If we wish to offer men a worth-while occupation, we must pay wages that are sufficient and that correspond to their station in life, and must assure them sufficient leisure to spend a few hours each day with their family. In these respects the Dutch railway men have made much progress since 1903. In that year a strike took place in consequence of which the international trains could hardly be run, while the State and the companies were scarcely able to comply with contract obligations. A law was passed by which (1) striking was prohibited, and (2) the conditions of labor were placed under State survey.

The improvements created in the conditions of labor of railway men in Holland, in consequence of this law, have been of the greatest importance, and that not least from a hygienic point of view.

We can say, in general, that as long as the conditions of labor are good, an excellent spirit will be maintained amongst the railway men, and with it a careful attention to duty upon which depends for the most part the safety of traffic. Good conditions of labor improve also the hygienic conditions under which the railway men's families live and promote the health and efficiency of the men. The wages of railway men in Holland are sufficient and proportionate to their work and their social position. A statement of the wages would be of no service, because the conditions in Holland are very unlike those in other countries, especially in America. It need only be added that the wages must be approved by the Government and that positions in the railway service are much desired.

From the following statement, published by one of our railway companies, you may learn that not every railway man is yet able to appreciate such favorable conditions, otherwise so many would not try to abuse them at the expense of the companies:

Period.	Number of men regularly employed.	Number of cases of illness.	Number of sick days.	Payment during sickness.
				Florins.
Nov. 1, 1903–Apr. 30, 1904.....	14,327	2,838	59,618	87,809.16
Nov. 1, 1907–Apr. 30, 1908.....	18,232	8,753	144,390	277,628.39
Increase.....per cent..	27	208	142	216

When criticizing these figures we must take into consideration that the number of hours of labor in the period between 1903 and 1907 had been considerably diminished, and that work in the service dur-

ing that period was in no way placed under less favorable hygienic conditions.

Another statement clearly shows that with our railway servants sickness is not always the real cause of absence from work. The following table indicates, for a period of a month for two companies, A and B, the percentage of absence (on account of sickness) to the total strength and the average duration of absence. We must remember that company A receives the full wages from the first day of absence, whereas company B does so only from the third day:

October, 1908.	Cases of illness per 100 servants.		Sick days per man.	
	A.	B.	A.	B.
Train servants	8.919	3.695	1.003	0.326
Engine servants	11.111	5.289	1.082	.517
Line keepers (male and female)	8.568	5.945	1.303	.864
Line workmen	7.222	3.885	.961	.491
Work-yard men	12.328	7.692	1.317	.653

Obviously exaggeration and simulation of sickness are, amongst the inferior servants, encouraged by the more liberal payment.

When a railway employee is unable to work in consequence of an accident on duty or of sickness not the result of his own neglect he receives full wages during 3 months; for the following 6 months he gets two-thirds, and for the next 3 months one-half. After a year's absence from work he receives, until recovery or dismissal, a salary equal to the pension to which he would have been entitled at the beginning of his sickness, according to the time he had served. Moreover, an additional sum is awarded to those who do not receive full wages on account of sickness or of an accident occurring in the line of duty. The amount depends on the length of service, e. g., a person having been 35 years in the service receives his full salary during the first 15 months of his sickness. When a man has resumed duty after sickness, and becomes again unable to do his usual work, his disability is considered to have been continuous if it has resulted from accident; but if a disabling sickness occurs twice, the interval being a month or longer, the second is considered a new sickness.

Railway men are entitled to an annuity when they have reached a fixed age, or sooner if they become invalid. The age for full pension varies in the different companies from 60 to 65 years; the required

time of service, from 30 to 40 years; and the amount of the pension, from one-half to two-thirds of the yearly wages.

Railway men performing their duty properly are entitled to certain holidays without loss of wages. Officials in the higher ranks can get from 14 to 30 days a year; other officers, 14 days; and the inferior grades, 7 days. The latter class can get extra days according to the number of years spent in the service.

The working time, where duty requires uninterrupted labor, may last not longer than 10 hours daily. The attendance of signalmen, pointsmen, and shunters must not exceed 12 hours a day, while linekeepers may not be kept on duty longer than 16 hours a day. All others must not exceed 16 hours a day, with the reservation that the total time of duty during 14 successive days must not exceed 168 hours. As regards punishments, fines, and loss of three or more holidays, the men have right of appeal to arbitration.

The companies can dismiss their employees. Should the discharge be unfair, and a certain pecuniary compensation not allowed, the dismissed man may call for arbitration. A maximum award, equal to wages for six weeks, can be granted.

The regulations of hours of duty and rest are of great importance to the hygienic life of railway men. The time of duty is regulated, but not the time of labor, and every man is subject to the regulations except the higher officials and the clerks of the directors' and exploitation offices. For all others it is provided that between two attendances there must be an uninterrupted period of rest for at least 10 hours. The minister of public works can shorten that period by one or two hours, but he seldom makes use of the power. During hours of duty the necessary interval must be allowed for meals. Female employees may not work between 10 o'clock in the evening and 5 o'clock in the morning.

The functionaries have every second or third Sunday off duty (24 hours); in the latter case 9 holidays of at least 30 additional hours every year. A certain number of the men have a holidy every fourth Sunday (28 hours). In that case they are entitled to 13 days of rest of 30 hours yearly.

Every possible precaution is taken to prevent professional diseases and accidents. Recent studies by one of the companies developed the fact that amongst 20,000 men examined not one was suffering from any occupational disease.

How far the measures taken to prevent accidents have been effective may be seen from the following statement:

List of accidents.

[D.=dead; I.=injured; S=suicide; Sh.=while shunting; W. F.=without fault; O. F.=through their own fault.]

Year.	Passengers.				Officials.						Persons injured on the line.			Number of passengers.
	W. F.		O. F.		W. F.		O. F.		Sh.					
	D.	I.	D.	I.	D.	I.	D.	I.	D.	I.	D.	I.	S.	
1875	....	9	1	1	1	2	9	13	....	....	7	1	....	8,945,331
1876	....	2	....	1	1	5	9	12	....	....	12	3	....	9,585,564
1877	....	1	....	2	....	9	14	11	....	....	9	....	....	10,041,844
1878	....	9	1	2	1	15	11	19	....	....	13	5	....	10,506,008
1879	....	13	1	2	8	24	11	11	....	....	15	5	....	10,759,823
1880	....	1	3	....	4	6	14	28	....	....	8	3	....	11,402,996
1881	2	11	2	....	2	14	18	32	....	....	14	1	....	11,780,719
1882	2	11	1	3	....	10	11	12	....	....	17	10	....	12,013,381
1883	....	1	1	2	2	6	16	30	....	....	20	7	....	12,485,653
1884	....	2	1	2	....	8	18	19	....	....	26	8	....	12,961,942
1885	....	10	....	....	12	15	13	3	....	....	14	4	....	12,825,970
1886	....	1	2	....	1	1	10	16	....	....	22	10	....	12,933,855
1887	....	....	....	2	2	7	18	9	....	....	25	7	....	13,510,022
1888	2	4	2	....	4	10	17	18	....	....	16	3	....	14,059,707
1889	....	6	1	3	1	8	11	11	....	....	18	7	....	14,612,345
1890	....	9	6	1	9	7	5	15	....	....	21	5	....	15,748,511
1891	....	2	2	2	6	23	16	15	....	....	21	16	....	22,117,715
1892	....	2	2	1	13	22	13	22	....	....	28	10	....	22,415,344
1893	....	10	2	3	7	43	10	13	....	....	21	12	....	23,550,262
1894	....	6	....	1	6	29	4	6	4	14	16	7	5	24,307,587
1895	....	....	2	6	8	26	4	9	....	4	19	12	9	25,224,121
1896	....	15	....	7	6	19	6	9	3	18	11	16	6	24,781,760
1897	....	10	2	4	10	23	6	6	3	5	20	11	2	25,022,251
1898	....	9	1	4	4	17	5	10	6	17	18	8	7	26,397,726
1899	9	35	4	1	6	19	3	5	9	16	13	8	4	27,864,280
1900	2	13	2	2	8	34	7	3	12	14	24	15	6	30,018,378
1901	1	15	3	9	8	25	6	10	12	23	19	16	5	32,689,602
1902	....	23	3	9	10	22	9	5	4	21	10	15	6	34,485,425
1903	....	14	4	9	8	24	10	9	11	21	23	19	5	36,366,963
1904	....	7	....	9	4	33	5	8	9	18	31	23	2	38,686,546
1905	1	2	5	4	11	31	13	12	9	15	23	17	4	39,246,961
1906	1	3	1	5	7	27	6	9	12	21	26	23	4	40,701,416
1907	1	8	2	5	7	30	2	4	9	20	25	23	2	40,976,953
1908	....	12	4	8	9	24	4	11	3	19	17	23	8	42,005,375
1909	1	8	2	9	4	26	9	18	7	15	9	22	7	43,155,799
1910	....	29	3	15	7	31	7	13	12	14	24	17	8	46,221,236
1911	....	12	3	9	4	33	5	16	2	22	20	19	3	44,874,577

[a] The actual number of passengers is, of course, much larger than here is mentioned on account of free tickets, season tickets, kilometer booklets, etc.

Whoever meets with an accident while on duty receives, from the Government insurance office, medical attendance, or a compensation in lieu of it. Further, temporary assistance is given, in the shape of 70 per cent of his wages, from the day of the accident until the forty-third day, in cases where the disability continues beyond the third day after the accident. If the injured man remains totally or partly unable to do his work, he receives further assistance from the insurance office, corresponding, in the case of total incapacity, to 70 per cent of his former wages; or, otherwise, a smaller amount, according to the extent of his unfitness for work.

As regards the service houses, it may be stated that the smallest of them, the dwellings for line keepers, must satisfy the following conditions:

The separate rooms must have the authorized capacity. The dwelling room, if it serves at the same time as a kitchen, must have a height of 3 meters and an area of 20 square meters, or in the case of two dwelling rooms with a separate kitchen, of 15 square meters. Alcoves, or very small bedrooms, may be built in the dwelling rooms, but only in case of necessity; they must have an arrangement for ventilation. The bedroom must measure at least 3 meters in height and 3 square meters in area; when it forms an entre-sol, a height of 2.9 meters is sufficient. The capacity may in no case be less than 30 cubic meters. The height of the cellar must be 1.55 meters, preferably 1.7 meters. The wall above the attic floor must be at least 1 meter in height. The ceilings of the attic rooms must be so pitched as to give half of the room a height of 2.2 meters and a total capacity of at least 20 cubic meters. The water-closet must be built in or against the house, in such a way that the tenants may enter it without going outside. The door must not be in one of the rooms or in the kitchen. A washhouse must be built to the house in which a separate kitchen is wanting. If the line keeper's house is situated in a lonely or out-of-the-way place, an oven is as a rule built close to the house.

Hitherto I have only spoken about legal regulations for the benefit of railway men. Other provisions are made, either by the companies or by the employees, but, in the latter case, the employees are usually helped by the companies. These institutions all help to diminish the cares of life, to make life more cheerful, and to avoid discontentment as much as possible. First we have to mention the unions which, in exchange for a small, regular contribution, procure surgical and medical attendance, medicines, pecuniary aid in cases of maternity, financial help at death, and, in some cases, dental services. These unions, in which all railway men expect the higher officials to participate, enjoy all kinds of assistance from the companies, and work so well that they most probably will become sickness clubs recognized by the Government.

The railway men have erected, principally by their own efforts, in a fine, healthy, richly wooded country, two convalescent homes, where members of their family may stay three weeks free of charge (or longer, by paying a small sum) after a prolonged illness, or for rest for overstrained nerves.

The Dutch railway servants are too few to be able to establish and maintain sanatoria for the treatment of tuberculosis. But, by payments from the sick clubs, such patients may from time to time be placed in public establishments. A union has been formed by the men, having as its purpose the spread of useful knowledge about tuberculosis and the means of its prevention.

A matter of the utmost importance to railway traffic is, without doubt, the use of alcohol by the railway men. Use leads to abuse, and the number of railway accidents, with loss of human life and of more or less considerable amounts of money, are innumerable. The Dutch companies do everything possible to prevent intoxication, and no alcohol is allowed during hours of service. A club of abstainers exists among the men, and the membership is steadily increasing. It is a pity that the railway companies do not offer any advantages to the members of the abstainers' club; experience has taught, however, that by doing so they foster hypocrites; but, considering the large profit that is produced by total abstinence, especially in railway traffic, the companies allow 475 guilders yearly to propagate the purpose of the above-mentioned club.

Other means to prevent weariness, public-house visits, and the abuse of alcohol are found in the allotment of land to certain servants for cultivation to their own profit, and in awarding prizes for the best flower beds on station grounds, embellishment of stations, etc.

Apiculture is encouraged, to promote sociability and to prevent idleness.

Some clubs supply the necessities and, in some cases, the luxuries of life at low prices. This business extends to music, excursions, drawing schools, professional education, loans, etc.

Finally, I present a statement showing the number of accidents among the railway functionaries in comparison with men working in some other trades:

Number of accidents and the results of them per 1,000 Dutch laborers.

[A.= Temporary (invalided not more than 6 weeks). B.= Temporary (invalided more than 6 weeks, and permanent invalidity). C.= Death.]

Trades.	1903			1904			1905			1906			1907			1908		
	A.	B.	C.	A.	B.	C.	A.	B.	C.	A.	B.	C.	A.	B.	C.	A.	B.	C.
Railway men	48.6	5.5	1.0	50.4	5.5	0.7	49.1	4.5	0.9	50.5	4.7	0.7	49.8	5.3	0.6	49.9	5.0	0.4
Steam-tramway men	91.3	7.1	.9	74.3	6.9	1.1	86.9	9.6	.6	78.8	8.0	.9	76.5	7.7	1.6	75.2	7.4	0
Electric-car men	40.8	5.9	0	54.9	6.2	0	48.5	5.1	.6	43.5	5.0	0	63.2	3.7	0	58.0	5.7	0
Persons employed in brickworks	55.9	5.5	.4	68.6	8.7	.2	72.7	9.1	.2	76.4	7.7	.4	77.8	8.4	.5	68.7	9.1	.4
Window cleaners	126.1	22.5	.....	106.5	29.3	.....	132.5	19.9	1.4	119.7	54.9	2.8	151.9	24.5	2.6	97.2	25.6	1.1
Painters and glaziers	27.4	3.9	.7	31.0	5.0	.3	55.2	9.1	.6	57.6	11.3	.2	57.8	8.5	.5	38.9	7.4	.3
Bricklayers	83.5	13.0	.9	92.3	14.1	1.1	102.2	15.7	.8	105.6	16.4	.3	107.4	16.8	.2	93.9	12.2	1.1
Carpenters	86.0	8.7	.6	99.2	9.4	.5	107.5	9.8	.6	115.8	10.6	.3	115.4	10.9	.4	100.2	9.5	.3
Building contractor's laborers	107.4	13.0	.8	117.5	15.4	.7	140.5	16.9	.4	138.1	16.2	.6	144.4	17.7	.4	123.2	14.3	.7
Steam and electric sawmill employees	83.8	12.4	1.6	87.1	14.7	.4	98.9	14.4	.6	115.4	18.7	.4	109.0	18.4	.8	103.8	15.3	.....
Employees in carpentry works	95.0	15.2	.9	122.2	19.2	.....	114.7	22.8	1.6	123.3	23.6	.....	130.9	30.5	.8	103.6	26.5	.....
Coal miners	166.1	17.3	2.7	249.0	22.0	2.2	260.2	24.3	2.7	246.2	18.4	2.0	212.7	14.8	1.6	223.0	13.9	2.0
Shipbuilders	123.1	9.5	.3	158.6	17.2	.5	151.4	14.0	.8	202.8	18.1	.8	196.3	17.4	.6	194.6	18.5	.5
Dock laborers	196.4	42.6	1.6	257.8	62.8	2.8	304.9	69.6	2.3	325.5	73.6	1.4	344.6	91.6	1.7	310.0	66.5	1.7
Bargemen	26.8	7.0	1.6	32.7	9.7	3.2	40.9	8.4	2.1	42.8	9.4	2.1	47.8	11.8	1.8	41.8	14.0	1.2
Steam tug men	66.6	13.3	.5	69.8	14.0	3.6	85.5	15.9	1.3	90.2	16.0	4.3	96.4	17.7	1.3	81.3	10.2	3.0
Steam and motor bargemen	69.0	11.1	2.0	88.3	13.1	1.9	98.0	12.9	1.2	100.7	17.4	2.0	107.1	18.8	2.2	182.2	22.9	4.2
Lorry men	106.2	22.9	.....	118.0	25.6	.6	130.9	26.6	1.7	142.0	35.9	1.1	145.4	37.0	.5	128.9	26.5	.9
Total industry	58.4	7.0	.5	67.9	8.7	.5	73.0	8.9	.4	80.3	9.6	.4	83.0	10.1	.4	74.5	8.5	.4

DIE GESETZLICHE BEKÄMPFUNG DES VERMEIDBAREN LÄRMS; EINE NERVENHYGIENISCHE FORDERUNG.

Dr. Siegmund Auerbach, Nervenarzt in Frankfurt am Main, Vorstand der Nervenpoliklink.

Wer es für angezeigt hält, gegen eine Erscheinung des täglichen Lebens zu kämpfen und zur Teilnahme an diesem Kampfe aufruft, der muss zunächst den Beweis erbringen, dass er gegen einen wirklichen Uebelstand ins Feld zieht; er muss dartun, dass durch diesen eine grosse Anzahl von Menschen tatsächlich geschädigt, in ihrer Gesundheit beeinträchtigt wird. Es genügt nicht, sich einer blossen Unannehmlichkeit entledigen zu wollen; in diesem Falle hätte man nicht das Recht, sich an die Oeffentlichkeit zu wenden.

Durch mannigfache Versuche ist festgestellt, dass schon Geräusche, die, wie in der Hypnose, gar nicht in das volle Bewusstsein der Versuchsperson treten können, eine deutliche Beeinflussung verschiedener Funktionen, deren Abhängigkeit vom Zentralnervensystem zweifellos ist, wie z. B. der Atmung, der Herztätigkeit, der Verdauung, zur Folge haben. Auch durch andere Experimente ist erwiesen, dass bereits die nicht bewusste Aufnahme von Geräuschen Nervenenergie in Anspruch nimmt. Nehmen wir die rein empirische Erfahrung, die durch mannigfache psychologische Versuche bestätigt wird, zu Hilfe, so wird jeder vernünftige Laie ohne weiteres zugeben, dass Kopfarbeit irgend welcher Art in einer Umgebung von Lärm und Geräuschen für die weitaus überwiegende Anzahl der Menschen einen erheblich grösseren Aufwand geistiger, d. h. nervöser Kraft erfordert, als in ruhigen Räumen. Jedem Arzte ist die Beobachtung geläufig, dass durch länger dauernde Reizungen eines einzelnen Sinnes das gesamte Nervensystem in Mitleidenschaft gezogen und hierdurch vorzeitig und übermässig ermüdet, erschöpft wird. Tritt zu diesem, die nervösen Zentralorgane, speziell das Gehirn, angreifenden Momente bei der geistigen Beschäftigung nun noch der Zwang hinzu, jene fortwährenden Sinnesreize, die sich gleichsam als Fremdkörper störend in das Bewusstsein drängen, zu unterdrücken und zu überwinden, um die erstrebte Leistung zu vollbringen, so resultiert hieraus ein ganz gewaltiger Verbrauch von Nervenkraft. Hierbei berücksichtige ich nicht einmal die für die Gemütsstimmung so nachteiligen, sich häufenden Unlustgefühle. Bedenkt man nun, wie tausendfältig diese Schädigungen tagtäglich auf uns einwirken, so kann jeder Unbefangene ermessen, was für eine Unsumme von Arbeitskraft auf diese Weise vergeudet und vernichtet wird. Kommt nun, wie es oft genug der Fall ist, noch hinzu, dass auch der Schlaf durch den Strassenlärm gestört oder verkürzt wird, so ist auch die wichtigste Erholung des überreizten Nervensystems illusorisch gemacht. Der Arzt, speziell der Nervenarzt, der es sich zur Regel gemacht hat, den Ursachen der Krank-

heiten nachzuspüren, kann Zeugnis dafür ablegen, wie oft die in unseren Grossstädten stetig zunehmenden Nervenleiden, insbesondere die Nervenerschöpfung (Neurasthenie), zu einem nicht geringen Teil auf den von Jahr zu Jahr wachsenden Lärm auf den Strassen und innerhalb der Häuser zurückzuführen ist. Nur der Eingeweihte weiss, welche Einbusse der Nationalwohlstand durch diese am Marke des Volkes zehrenden Krankheiten erleidet, wieviel Familienglück durch sie zerstört wird.

Es ist auffallend, wie wenig sich bis jetzt die Hygiene, deren vornehmste Aufgabe es doch ist, Krankheiten zu verhüten und ihre Ausbreitung zu verhindern, um die Prophylaxe der Nervenkrankheiten gekümmert hat. Sie treten allerdings nich so akut- und massenhaft auf, wie manche Infektionskrankheiten, gegen die sofort die Behörden und bald auch die Gesetzgebung in Bewegung gesetzt wird; sie nagen langsamer, aber mit unfehlbarer Sicherheit an einem der grössten Schätze, die die Menschen besitzen, nämlich an ihrer Arbeitskraft. Auf der Versammlung des Deutschen Vereins für öffentliche Gesundheitspflege in Wiesbaden 1908 wurde ein Referat "Ueber die Ursachen der Nervösität" erstattet, und hier hat der Referent, Prof. Cramer, aus Göttingen, anerkannt, dass der Lärm als eine Ursache dieses Leidens anzusehen und deshalb zu bekämpfen ist.

Ich bin weit davon entfernt zu behaupten, dass der Lärm die einzige Ursache der verbreitesten Nervenkrankeiten ist. Zu ihrer Entstehung tragen viele ursächliche Momente bei, und unter diesen sind wieder zahlreiche, die man als unabänderlich leider hinnehmen muss, vor allem die sog. endogenen, die in der Konstitution des Menschen begründet sind. Um so mehr muss man sich gegen die exogenen Faktoren wenden, d. h. gegen diejenigen, die von aussen an den Menschen herantreten, und die man einigermassen beherrschen kann. Zu den letzteren gehören die übermässigen acustischen Reizungen des Zentralnervensystems, gegen die man sich viel schwerer schützen kann, als gegen Lichtreize. An ounce of prevention is worth more than a pound of cure! Dem grossen Publikum muss die Erkenntnis beigebracht werden, dass die Vermeidung unnötigen Lärms für die Gesundheit ebenso notwendig ist wie die Beschaffung guten Trinkwassers oder die Einführung der Kanalisation.

Nun hat man behauptet, man könne und müsse sich gegen die zunehmenden Geräusche des Alltaglebens abhärten, man könne sich anpassen. Wenn das nur so leicht ginge! Ich wäre einer der ersten, die dafür plädieren würden. Jener Ansicht liegt eine Selbsttäuschung zugrunde, auch wenn man von bereits Nervösen absieht. Natürlich darf man auch der Verwöhnung nicht das Wort reden. Ein berühmter Historiker hat als ein Charakteristikum unserer Zeit die "Reizsamkeit" bezeichnet. Ich glaube, er hat sehr recht. Von den reizsamen Menschen unserer Grossstädte kann man aber, wenn

anders man sie nicht zu einem direkt schädlichen Aufwand von Nervenenergie verleiten will, nur bis zu einem gewissen Grade verlangen, andauernde und starke Sinnesreize zu überwinden. Was darüber hinausgeht, ist, wie ich vorhin gezeigt habe, vom Uebel. Man muss sich eben mit der Tatsache abfinden, dass die Welt reizsamer, d. h. nervöser geworden ist. Ganz besonders geht das die Verwaltungsbehörden, die Rechtsprechung und die Gesetzgebung an.

Es ist bekannt, dass Goethe seine Willenskraft aufs äusserste anspannte, um persönlicher Mängel und Missempfindungen Herr zu werden. Ebenso wie er versuchte, ein störendes Schwindelgefühl beim Herabblicken von Türmen oder Anhöhen zu unterdrücken, so wollte er sich auch seine Empfindlichkeit gegen Lärm abgewöhnen, indem er in Strassburg oft hinter der Trommel der Soldaten herging. Es hat ihn nichts genützt. Sogar in dem stillen Weimar hatte er fortwährend über Unruhe und Lärm zu klagen. Hat er doch noch im Alter ein Nachbarhaus angekauft, nur um nicht durch den Lärm eines geplanten Umbaues gestört zu werden. Bekannt ist auch Schopenhauers Philippika gegen Lärm und Geräusch. Eine grosse Zahl geistig hervorragender Menschen reiht sich an; ich nenne nur Kant, Schiller, Jean Paul, Heine, Richard Wagner, Friedrich Theodor Vischer und namentlich Thomas Carlyle. Stets ist es die Kopfarbeit und der Schlaf, deren Schutz diese Männer verlangen. Gewiss ist die Empfindlichkeit gegen Geräusche individuell verschieden gross. Im allgemeinen kann man aber wohl sagen: Je komplizierter und feiner ein Gehirn gebaut ist, desto störender werden zwecklose Gehörseindrücke empfunden. Und es wird wohl niemand behaupten wollen, dass die Welt kein Interesse daran hätte, diese Gehirne zu schützen.

Es erhebt sich nun die Frage: Welche Arten von Lärm sind namentlich zu bekämpfen? Hier scheint es nur von grosser Bedeutung zu betonen, dass man nur den vermeidbaren Lärm, die unnötigen Geräusche in Angriff nehmen kann und soll. Nichts wäre thörichter als utopistische Pläne zu verfolgen. Man kann die Grenzen der Lärmbekämpfung vielleicht folgendermassen abstecken: *Es handelt sich um solche Geräusche, durch die eine grössere Zahl von Einwohnern in ihrer Gesundheit geschädigt werden, durch deren Beseitigung, Milderung oder gesetzliche Regelung aber berechtigte Interessen anderer nicht in erheblicher Weise verletzt werden.* Man muss auch hier den Grundsatz aufstellen, dass in zivilisierten Ländern der Störenfried das Feld zu räumen hat. Geht man von diesem Standpunkte aus, so scheidet die Gruppe von Geräuschen zum Teil aus, die durch die Verkehrsentwicklung bedingt sind, so z. B. die durch Eisenbahn und Strassenbahn hervorgerufenen. Es ist natürlich ausserordentlich wünschenswert—und die Technik strebt auch dahin—dass der durch diese Verkehrsmittel verursachte Lärm auf ein erträgliches Mass gebracht werde. Was bei Anwendung der

heute schon zu Gebote stehenden Mittel erreicht werden kann, zeigt z. B. die Frankfurter städtische Strassenbahn, die auf einzelnen Linien mittelst zweckmässiger Schieneneinbettung einen geradezu ideal ruhigen Gang fertig gebracht hat; man vergleiche hiermit das förmliche Getöse in Berlin oder gar München oder hier in Amerika. Vielleicht könnte das Signalgeben noch etwas eingeschränkt werden. In den grössten Städten wird man wohl in absehbarer Zeit dahin kommen, den Massenverkehr unter die Erde zu verlegen, wie es in verschiedenen Metropolen ja schon der Fall ist. Wir können aber den Verkehr nicht zurückschrauben; auch hat der Einzelne es einigermassen in der Hand, entfernt von der Strassenbahn zu wohnen, falls diese allzusehr stören sollte.

Was die vermeidbaren oder regulierbaren Geräusche anbelangt, so möchte ich zunächst die mit unserer Hauswirtschaft verknüpften erwähnen und in erster Linie das Klopfen der Teppiche, Polster und Betten, durch welches eine grosse Anzahl von Einwohnern in hohem Masse gestört und geschädigt wird. Neben der grossen Infektionsgefahr, die durch das Aufwirbeln des Staubes in den Höfen, auf den Veranden und Gängen herbeigführt wird, kommt hier vor allem der dröhnende Lärm in Betracht, der bei der jetzigen Rechtslage in Preussen—ich komme auf diesen Punkt nachher zurück—von morgens bis abends ohne jede Einschränkung von jedermann ganz nach Belieben gemacht werden kann. Trifft man es besonders ungünstig, so kann es leicht passieren, dass, wenn die eine Partei des Hauses aufhört, die andere anfängt, oder dass, wenn die Hausgenossen das Reinigungsgeschäft nun glücklich vollbracht haben, die Nachbarn anfangen, einer hübsch nach dem anderen. Man kann sich denken, was für Qualen ein armer Kopfarbeiter oder ein Kranker bei diesem Höllenlärm aushalten muss. Da muss man doch die Frage aufwerfen: Wessen Interesse wird tatsächlich verletzt, wenn dieser Lärm auf bestimmte Tage und Stunden eingeschränkt wird? Man hat bekanntlich schon seit längerer Zeit begonnen, technisch durch Vakuumreinigung, auch durch nicht maschinelle, diesem Uebelstande abzuhelfen. Ich glaube auch, dass durch eine zielbewusste Zentralisierung dieser Hausarbeit Abhilfe geschaffen werden könnte. Diese Fortschritte bahnen sich aber erst langsam an, und unsere Generation kann nicht darauf warten, bis die erwähnte Misere auf dieser Weise beseitigt ist. Sie wäre aber mit Leichtigkeit erträglich zu gestalten, wenn sich nur die höchsten Gerichte bei ihren Urteilen von etwas modern-hygienischem Geiste leiten liessen. Ich komme später auf diese Frage zurück.

Hier anzureihen wären die durch das Zusammenleben mit Haustieren erzeugten Geräusche, vor allem das Gebell der Hunde und das Krähen der Hähne. Uebermässiges Hundegebell zur Nachtzeit

wird auch jetzt schon in Deutschland durch die Polizei geahndet. Wird aber gegen das polizeiliche Strafmandat richterliche Entscheidung angerufen, was bekanntlich jedem freisteht, so verlangt das Gericht den direkten, zeugeneidlichen Beweis, dass es nur der beschuldigte Hund gewesen sein kann, falls der Besitzer den Einwand erhebt, der seinige habe gar nicht gebellt oder geheult. Diesen direkten Beweis könnte man aber, da es sich meist um nächtliche Ruhestörung handelt, m. E. nur so liefern, dass man eine Blitzlichtaufnahme des bellenden Hundes dem Gerichte überreicht und so die Identität beweist. Der Hundelärm, der in den europäischen Grosstädten eigentlich nur nachts störend wirkt, könnte durch weitere Erhöhung der Steuer noch bedeutend vermindert werden. Auch sollte man endlich dazu übergehen, mehr von den viel sichereren automatischen elektrischen Signalvorrichtungen bei der Bewachung von Häusern und Höfen Gebrauch zu machen. Das Halten eines Hühnerhofes in einer Grossstadt müsste unter allen Umständen generell verboten werden. Lediglich um sich ein Vergnügen zu bereiten, hat niemand das Recht, seine Mitmenschen zu belästigen, und frische Eier bekommt man jetzt auch im Winter in genügender Menge. Es ist doch wirklich eine starke Zumutung, sich in der gerade genug Lärm liefernden Stadt auch noch den Lärm der Landwirtschaft gefallen lassen zu müssen.

Es ist vielleicht nicht geschmackvoll, vom Lärm der Haustiere direkt auf den Musiklärm überzugehen; es besteht aber—das wird nicht bestritten werden können—ein Zusammenhang insofern, als sie beide an das Haus gebunden sind. Schon vor längerer Zeit habe ich mehrere Vorschläge gemacht, wie dem schlimmsten aller Teufel, dem Musikteufel zu Leibe zu rücken wäre, oder wie man ihn wenigstens in seinen gefährlichsten Lebensäusserungen bändigen könnte. Man darf aber auch hier nicht über das Ziel hinausschiessen. Oeffentlich, d. h. polizeilich bezw. gesetzlich verboten werden müsste das Musikmachen und Singen bei geöffneten Fenstern, auch bei Tage, das unbegreiflicherweise fast überall gestattet ist; der Missbrauch von Grammophonen, namentlich auch bei geöffneten Fenstern oder Türen, und die Drehorgelmusik auf den Strassen oder Höfen. Auch hier müsste der Grundsatz zum Durchbruch kommen, dass derjenige, der den Lärm macht, sich nach den Bedürfnissen der ruhigen Einwohner zu richten hat, und nicht umgekehrt. Berufsmusiker, Sänger oder Privatleute (soweit sie nicht Häuser zum Alleinbewohnen besitzen), die länger als etwa 4 Stunden auf einem Instrumente spielen wollen, müssten das entweder in zentralen Uebungskonservatorien tun, oder es müsste ihnen das Wohnen in bestimmten Strassen verwehrt werden. Derjenige, der Ruhe zu seinem Berufe nötig hat, muss wissen, in welchen Strassen ihm diese wenigstens

cinigermassen gewährleistet wird; er darf nicht der Gefahr ausgesetzt sein, bei jedem Umzugstermin von einer Wohnung in die andere gehetzt zu werden. Was das gewöhnliche mässige Musiküben in von mehreren Parteien bewohnten Häusern anbetrifft, so muss der Hauswirt dafür sorgen, dass die Uebstunden nach Möglichkeit reguliert und den einzelnen Parteien bekannt gegeben werden; in den frühen Morgenstunden, während einer Stunde in der Mittagszeit und in den letzten Abendstunden muss Ruhe herrschen. Auch hier muss der Kopfarbeiter wissen, wann er die Möglichkeit hat, konzentriert zu arbeiten. Baugesellschaften oder ähnliche Interessenten sollten versuchen, Häuserblocks zu errichten, in denen Musik und Gesang allgemein nicht zugelassen wird. Ich möchte annehmen, dass ein solches Unternehmen reüssieren würde.

Dem Unfug der gehäuften Konzerte in Hotels, Restaurants und Cafés müsste von seiten des besuchenden Publikums gesteuert werden. Manchmal scheint es heute wirklich, die Menschen hätten nichts weiter zu tun, als sich fortwährend mit Musik zu betäuben.

Militärmusik beim Ausrücken der Truppen in aller Frühe müsste unterbleiben.

Ich gehe nun über zu den unnötigen Geräuschen ausserhalb der einzelnen Häuser. Von den Automobilen muss unbedingt verlangt werden, dass sie beim Halten vor den Häusern die Motoren gänzlich abstellen; die geringen dadurch etwa entstehenden Mehrkosten können gar nicht in Betracht kommen gegenüber der störenden Belästigung. Das übermässige Signalgeben ist einzuschränken; man darf hier aber nicht allzuviel verlangen, ohne die Sicherheit im Strassenverkehr zu gefährden. Wenn die Maximal-Fahrgeschwindigkeit innerhalb der Stadt herabgesetzt würde, dann brauchten auch weniger Signale gegeben zu werden. Von grosser Bedeutung wäre die Einrichtung von besonderen Automobilstrassen auch innerhalb der Städte. Das Peitschenknallen muss als ganz überflüssiges Geräusch allgemein verboten werden. Lastwagen mit Eisenschienen oder songstigen Lärm hervorrufenden Materialien müssen zu entsprechenden Sicherungen angehalten werden. In New York besteht ein Gesetz, nach dem das Unterlassen solcher Massnahmen mit hoben Geldstrafen geahndet wird. In einigen deutschen Staaten und Städten bestehen Polizeiverordnungen dieser Art.

Das Läuten von Kirchenglocken sollte auf ein erträgliches Mass beschränkt werden. In der Frühe müsste es ganz unterbleiben. Zum Wecken der Schläfer gibt es doch jetzt andere Vorrichtungen, deren Wirkung auf die betreffenden Personen beschränkt bleibt. Das Schlagen von Uhren an Kirchen, Schulen und sonstigen öffentlichen Gebäuden zur Nachtzeit müsste eingestellt werden, da die hierdurch verursachte allgemeine Störung den Vorteil, den es vielleicht ein-

zelnen Personen gewährt, ganz bedeutend überwiegt. Auch am Tage erscheint mit die Zweckmässigkeit des lauten Verkündens der Zeit heutzutage sehr problematisch.

Der durch Neu- und Umbauten hervorgerufene, in unserer Zeit durch die allgemeine Anwendung der eisernen Träger ganz besonders laut gewordene Lärm, könnte bei einigem guten Willen gleichfalls erträglicher gestaltet werden. Sollte es wirklich ganz unmöglich sein, die den schlimmsten Lärm erzeugenden Arbeiten wenigstens in den frühesten Morgenstunden und während der Mittagsruhe zu unterlassen? Könnte diese Zeit nicht vielleicht mit weniger störenden Arbeiten ausgefüllt werden?

Ferner muss die nächste Umgebung von Schulen und Hospitälern vor Lärm geschützt werden, wie es in New York durch die Einrichtung der sog. quiet zones bereits geschehen ist. Jeder irgendwie vermeidbare Lärm muss hier strengstens verboten werden.

Ausser diesen in der ganzen Welt verbreiteten Arten des Lärms gibt es noch eine ganze Reihe local beschränkter, die nicht weniger schädlich wirken und energisch bekämpft werden müssen.

Welche Mittel stehen uns zur Zeit bei diesem Kampfe zur Verfügung?

Es ist ganz selbstverständlich, dass das gütliche Uebereinkommen mit Hausgenossen und Nachbarn immer zuerst zu versuchen ist. Wer aber Erfahrung besitzt, wird mir zugeben, dass das Entgegenkommen in dieser Beziehung im allgemeinen leider ein sehr geringes ist, sogar in Krankheitsfällen. Auch das energische Auftreten einer grösseren Organisation hilft gewöhnlich nicht viel. Ich könnte haarsträubende Dinge aus der ärztlichen Praxis erzählen, sowie aus den Erfahrungen, die ich als Vorsitzender der Antilärmsection des Frankfurter Vereins für Hygiene gemacht habe. Es ist deshalb von ernst zu nehmender Seite empfohlen worden, Gleiches mit Gleichem zu vergelten oder sogar zu übertrumpfen. Ich möchte das aber nicht unterstützen oder wenigstens nur für dringende Notfälle empfehlen.

Die bis jetzt gegründeten Organisationen zur Bekämpfung des Lärms haben in Ganzen nur geringe Erfolge aufzuweisen, so auch der vor mehreren Jahren gegründete Deutsche Lärmschutzverband. Etwas mehr scheint die New Yorker Society for the Suppression of Unnecessary Noise, und das Londoner Street-Noise Abatement Committee erreicht zu haben, und zwar mit Hilfe der Behörden resp. der Gesetzgebung.

Schon kurz erwähnt habe ich einige Hilfsmittel, welche die Technik zu bieten vermag. Beim Bau der Häuser könnte noch viel mehr auf schalldämpfendes Füllungsmaterial, auf dicke Mauern und Zwischenwände geachtet werden; Doppelfenster sollten viel mehr angebracht werden als bis jetzt. Haenel [1] hat in dieser Beziehung sehr beachtenswerte Vorschläge gemacht. Behufs Abdämpfung des

Schalles von der Strasse her hat man ja schon seit längerer Zeit Asphalt- und Holzpflaster eingeführt; es ist zu hoffen, dass die fortgesetzten Versuche noch andere, vielleicht weniger kostspielige und noch wirksamere Materialien auffinden lassen.[2]

Es wäre ferner ausserordentlich wünschenswert, wenn uns eine Art von Universalmittel zu Gebote stünde, welches wir in allen Lagen des Lebens an unserem Körper zur Abdämpfung der Schallwellen anbringen könnten, eine Vorrichtung, die uns der Rücksichtnahme seitens unserer Mitmenschen überheben würde. Da ich selbst seit einiger Zeit mit Untersuchungen dieser Art beschäftigt bin, so kann ich nur versichern, dass die Lösung dieses Problems viel grössere Schwierigkeiten darbietet, als man gewöhnlich glaubt. Sie sind anatomischer, physiologischer und physikalischer Natur, und deshalb muss von verschiedenen Seiten zusammen gearbeitet werden, um zum Ziele zu kommen. Ein grosser Uebelstand ist hier der Mangel brauchbarer experimentell-physikalischer Grundlagen. Die jetzt vorhandenen Antiphone aus Metall, Gummi, Wachs, Paraffin und dergl. haben sämtlich nur einen sehr beschränkten Wert, weil sie: 1. Den Schall nur mangelhaft dämpfen; 2. weil sie die im äusseren Gehörgang liegenden Gefühlsnerven reizen und deshalb in der Regel für längere Zeit nicht ertragen werden; 3. weil sie die schalleitende Funktion der Ohrmuschel gar nicht berücksichtigen. Die Hoffnung, ein geeignetes Instrument herzustellen, braucht aber deshalb noch keinewegs aufgegeben zu werden.

Endlich bleibt noch der Schutz von seiten der Verwaltungsbehörden und der Gerichte bezw. der Gesetzgebung. Es soll nicht bestritten werden, dass es ein wenig besser geworden ist, als es vor 50 Jahren war, da durch eine Entscheidung des höchsten Reichsgerichtes der Satz aufgestellt wurde, das jedermann auf seinem Grund und Boden soviel Lärm machen könne wie er wolle. So schlimm steht es heute glücklicherweise nicht mehr; viel besser ist es aber auch nicht geworden. *Sicherlich hat die Gesetzgebung in keinem Lande sich der ungeheuren Zunahme des Lärms einerseits, der ständig wachsenden Nervosität andererseits angepasst.*

Es würde zu weit führen, wenn ich hier die gesamte Rechtslage auch nur im Gebiete des Deutschen Reiches darlegen und die in Betracht kommenden Paragraphen des Strafgesetzbuches, des Bürgerlichen Gesetzbuches, und der Verwaltungsgesetze, namentlich der Gewerbeordnung, besprechen wollte. Ich möchte nur das in öffentlich-rechtlicher Beziehung Wichtigste erwähnen:[3]

Als gesetzliche Grundlagen für die wenigen, jetzt angewendten polizeilichen Verfügungen gegen den Lärm bestehen folgende Bestimmungen:

Für Preussen gilt das Allgemeine Landrecht, II. Teil, Kapitel 17, §10: "Die nötigen Anstalten zur Erhaltung der öffentlichen

Ruhe, Sicherheit und Ordnung, und zur Abwendung der dem Publico oder einzelnen Mitgliedern desselben bevorstehenden Gefahr zu treffen, ist das Amt der Polizei." Auf Grund dieses Paragraphen hat das preussische Oberverwaltungsgericht, welches die höchste Instanz für Vergehen gegen die Gewerbeordnung ist,[4] folgendes wichtige Urteil gefällt: Dem Gastwirt O. war auf die erfolgte Beschwerde mehrerer Nachbarn durch die Polizeidirektion des betreffenden Ortes verboten worden, sein Orchestrion länger als bis 10 Uhr abends spielen zu lassen, und die Erlaubnis zu spielen beschränkte sie auf wenige Tagesstunden und auch dann nur bei völlig geschlossenen Türen und Fenstern.

Der ausserordentlich klaren und vernunftgemässen Begründung entnehmen wir folgendes:

Das Amt der Polizei ist es, die nötigen Anstalten zur Erhaltung der öffentlichen Ruhe, Sicherheit und Ordnung und zur Abwendung der dem Publikum bevorstehenden Gefahren zu treffen. Es kommt also im vorliegenden Fall darauf an, ob durch das mit dem Spiel des betreffenden Orchestrions verbundene Geräusch nach seiner Art und Dauer die Gesundheit der Anwohner gefährdet wurde. Und zwar genügt es, wie der Gerichtshof bereits wiederholt ausgesprochen hat, zum Einschreiten der Polizei, wenn auch nur die Gesundheit bereits nervöser Personen gefährdet wird, da die Nervosität gegenwärtig ein weit verbreitetes Leiden ist, und ferner, wenn auch nur die Gesundheitsbeschädigung einer einzelnen Person in Frage steht.

Sie werden mir zugeben:

Wenn die Motivierung dieser Entscheidung des höchsten preussischen Verwaltungsgerichtes der Rechtssprechung allenthalben zugrunde gelegt würde, so könnte sich wirklich jedermann zufrieden geben. Nun ist aber bekanntlich die oberste Rekurs-Instanz (in Preussen) für Verurteilungen wegen Uebertretungen von Polizeiverordnungen das Kammergericht. Und dieses steht leider auf einem ganz anderen Standpunkte.

Die Polizei hat in Frankfort am Main wie anderen Grossstädten eine wirklich bescheidene und doch einigermassen wohltätige Verordnung erlassen, nach welcher das Klopfen der Teppiche, Betten, u. s. w., nur an den Wochentagen von 8–12 Uhr vormittags gestattet war. Das Kammergericht hat in einer Entscheidung vom 17. September 1906 (und auf diese Entscheidung berufen sich seitdem die niederen Instanzen in ihren Urteilen) diese Polizeiverordnung für ungültig erklärt, und zwar mit folgender, für jeden Sachverständigen durchaus verfehlter Begründung. Die Polizei könne Verordnungen, dass nur an bestimmten Tagen oder zu bestimmten Stunden geklopft werden dürfte, nur für Bade- und Kurorte erlassen. Ein Kurinteresse sei jedoch nicht anzuerkennen, wenn es sich um eine Grossstadt handele, in der die durch das Teppichklopfen verursachte Staubentwicklung und Störung im Verhältnis zu den durch den sonstigen Verkehr und die industriellen Unternehmungen hervorge-

rufenen Uebelstände eine nur untergeordnete Rolle spielen. Zum Schutze von Leben und Gesundheit können derartige Polizeiverordnungen nicht erlassen sein, weil nicht einzusehen sei, wie dann bestimmte Tage oder Stunden freigegeben werden können. Sollte die Polizeiverordnung aber gegen die durch Lärm verursachte Belästigung erlassen sein, so komme in Betracht, dass schon der § 360, 11 des Reichsstrafgesetzbuches (der bekannte Grobe-Unfug-Paragraph) mit Strafen den bedroht, der "ungebührlicherweise ruhestörended Lärm errege." Es gehöre nicht zu den Aufgaben der Polizei, die Nachbarn vor Ruhestörungen zu schützen. Die Polizeibehörden seien nicht berechtigt, die erwähnte Bestimmung des Strafgesetzbuches zu erweitern. Von demselben Standpunkt aus hat das Kammergericht eine Polizeiverordnung für ungültig erklärt, welche vorschrieb, während welcher Zeit mechanische Musikinstrumente spielen dürfen; ferner eine solche, die einem Molkereibesitzer verbot, während der Nachtzeit mit seinen Milchkannen so zu klappern, dass di Nachtruhe der Anwohner gestört wurde. Sowohl das Amts- wie das Landgericht hatten den Mann verurteilt. Diese Entscheidungen des Kammergerichts sind ganz unbegreiflich. Durch sie wird das Lärmmachen geradezu in Permanenz erklärt. Weil in der Grossstadt ohnehin schon genug Staub und Lärm bestehe, so könne eine besondere Form dieser Schädlichkeiten nicht verboten werden.

Das Reichsgericht scheint mehr den Anschauungen des preussischen Oberverwaltungsgerichtes zuzuneigen. Durch das Geräusch, das der Betrieb von Fleischermaschinen im Erdgeschoss und im Keller verursachte, wurden die Bewohner der darüber liegenden Räume erheblich belästigt und in ihrer Ruhe, auch in ihrer Nachtruhe, gestört. Das Reichsgericht erblickte hierin eine Gesundheitsgefährdung des Mieters und erkannte dessen Kündigungsrecht auf Grund des § 544 des Bürgerlichen Gesetzbuches an. Ich möchte auch den Prozess erwähnen, den der Besitzer eines Hotels in Eisenach gegen die Kirchengemeinde zu führen hatte, von der er beanspruchte, dass sie die in seiner Nähe gelegene Kirchenuhr bei Nacht abstellen solle, weil seine ruhebedürftigen Gäste durch das nächtliche Schlagen der Uhr im Schlafe gestört würden. Dieser Prozess wurde durch Spruch des Reichsgerichtes zuungunsten der Kirchengemeinde entschieden und bildet einen wichtigen Präzedenzfall für künftige Klagen ähnlicher Art.

Man wird zugeben, dass man sich einen grösseren Gegensatz in den Ansichten über die hygienische Schädlichkeit des Lärms, wie in den angeführten Urteilsbegründungen des Oberverwaltungs- und Reichsgerichts einerseits und des Kammergerichtes andererseits zutage tritt, gar nicht denken kann. Nicht nur der sachverständige Arzt, sondern jeder hygienisch einigermassen gebildete Laie muss die Entscheidungsgründen des letzteren Gerichtshofes für höchst befremdlich

halten. Hierzu kommt noch ein ausserordentlicher Wechsel in der Beurteilung der Lärmdelikte seitens derselben Gerichtshöfe, je nachdem dieser oder jener Senat die Entscheidung zu fällen hat.

Da nun aber die Polizeibehörde im Weigerungsfalle der Uebertreter kein anderes Machtmittel besitzt, als Geldstrafen zu verhängen, und gegen diese selbstredend auf Grund der Entscheidungen der höchsten Rekursinstanz gerichtliche Entscheidung angerufen wird, so ist die Initiative der Polizei auf diesem Gebiete, wenigstens für Preussen, völlig lahm gelegt, wenn nicht in Zukunft jene Entscheidung durch einen anderen Spruch desselben Gerichts korrigiert wird. Die Polizei kann natürlich nicht weiter Strafen wegen Uebertretung von Verordnungen auferlegen, die von dem höchsten zuständigen Gerichtshof für rechtsungültig erklärt worden sind. Es bleibt somit meines Erachtens nichts übrig, als einen anderen Weg zu beschreiten, um einen wirksamen Schutz zu schaffen gegen die Gesundheitsstörungen, die durch den zunehmenden Lärm verursacht werden.[5]

Da die Rechtssprechung unserer Zeit gezeigt hat, dass es nicht angängig ist, dem Richter auf diesem Gebiete zu viel Spielraum zu lassen, so muss meines Erachtens die Klinke einer speziellen Gesetzgebung und zwar der Reichsgesetzgebung, in Bewegung gesetzt werden. Ebenso wie wir ein Reichsgesetz (vom 14, Mai 1879) betreffend den Verkehr mit Nahrungsmitteln u. s. w. wie wir ein solches (vom 25. Juni 1887) betreffend den Verkehr mit blei- und zinkhaltigen Gegenständen und noch mehrere andere, die Gesundheit schützende Reichsgesetze haben, so muss auch ein solches betreffend die Gesundheitschädigung durch Lärm erlassen werden. In London hat das Street-Noise Abatement Committee ein Gesetz beim Parlament beantragt und, soweit ich unterrichtet bin, auch durchgesetzt, das gegen den durch die Orgelspieler und Strassenausrufer verursachten, die geistige Arbeit störenden, Lärm einschreiten soll.

Einem wirksamen Gesetze dieser Art müsste die erwähnte moderne und echt hygienische Betrachtungsweise des Oberverwaltungsgerichtes zugrunde gelegt werden. Es müsste die Erregung solcher Geräusche unter Strafe stellen, durch die eine grössere Zahl von Einwohnern in ihrer Gesundheit geschädigt werden, durch deren Verbot aber berechtigte Interessen Anderer nicht in erheblichem Masse verletzt werden. Es hat natürlich auch hier wie im gesamten Rechtsleben der modernen Grundsatz zu gelten, dass das Recht und Interesse des Einzelnen zu Gunsten der Allgemeinheit zu weichen hat.

Unbedingt verlangt werden müsste eine möglichst scharfe Concretisirung der Tatbestände, die bekanntlich die erste Voraussetzung jeder Rechtssicherheit im Strafrecht ist. Nur so können anfechtbare juristische Constructionen ausgeschaltet werden. Auch der Poli-

zeiwillkür würden auf diese Weise wirksame Schranken gesetzt. Deshalb wäre es auch zweckmässig, die verschiedenen Arten des Lärms anzuführen, die geeignet sind, die Gesundheit zu schädigen, hier aber einen Ausbau des Gesetzes mit Rücksicht auf die Möglichkeit neu auftauchender lärmverursachender Verkehrsmittel und ähnlicher Dinge offen zu halten; ferner die Befugnisse der Polizei ähnlich wie im Nahrungsmittelgesetz möglichst zu fixieren und endlich in schwieriger zu beurteilenden Fällen die Bestellung von Sachverständigen ins Auge zu fassen. Als solche müssten Hygieniker, Nerven- und Ohrenärzte herangezogen werden. Schon die blosse Existenz eines derartigen Gesetzes würde meines Erachtens vor vielen jetzt alltäglichen Rücksichtslosigkeiten schützen.

Ich bin mir wohl bewusst, dass die strafrechtliche Regelung dieser Materie keine leichte Aufgabe sein wird. Aber sie wird möglich sein, wenn der Wille dazu vorhanden ist. Für das Deutsche Reich wird das Reichsgesundheitsamt, das auf so vielen Gebieten schon Mustergültiges geschaffen hat, diese wichtige Frage in Angriff nehmen müssen, vielleicht im Connex mit dem geplanten Reichswohnungsgesetze.

Es wird sich den Dank von vielen Tausenden und ein grosses Verdienst um die Volksgesundheit, um die Verhütung der Nervenerschöpfung erwerben, wenn es auch hier den Weg zur Abhilfe bahnt. Videant consules!

Es leuchtet ein, dass die vorstehenden Grundsätze für den Erlass solcher Gesetze auch in anderen Ländern mutatis mutandis angewendet werden müssen. Man erstrebe auch hier definitive Gesetze und beschränke sich nicht auf polizeiliche Verordnungen, die vom Richter jederzeit aufgehoben werden können.

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[1] Deutsche med. Wochenschr., 1912, No. 10.

[2] Vgl. Pinkenburg: Der Lärm in den Städten u. seine Verhinderung. Handbuch der Hygiene von Th. Weyl, 3. Supplementband.

[3] Eine brauchbare Zusammenstellung der einschlägigen gesetzlichen Bestimmungen und der bisher ergangenen Gerichts-Entscheidungen findet sich bei Beuttenmüller: Der rechtliche Schutz des Gehörs. Karlsruhe, Braun'sche Hofbuchdruckerei, 1908.

[4] Veröffentlichungen des Kaiserlichen Gesundheitsamtes vom 8. November 1905, zitiert nach Med. Klinik, 1905, No. 52.

[5] Vgl. Auerbach: Ein Reichsgesetz, betreffend die Gesundheitsschädigung durch Lärm. Medizin. Klinik, 1908, No. 14.

SANITATION OF STREET CARS.

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Although the title of this paper is broad enough to cover all the phases of sanitary control of street cars, the program of the congress includes a separate paper on ventilation and heating. This arrangement is well advised, since these two subdivisions of sanitation have given the investigators of the subject enough data for many lengthy articles, some of which have been published in professional or technical journals, or as individual reports. They are intimately correlated, and are indeed most important factors in proper sanitation, but in this paper they will be mentioned only as they affect the cleaning or disinfecting branch of the subject under discussion.

As a result of extended experiments with different types of ventilating systems, it appears as an almost unanimous recommendation that the entrances for fresh air should not be in the floor of the car. In Chicago the city ordinance " relating to the comfort and safety of passengers " specifically requires that " the openings of the air intakes shall be constructed and maintained so as to be protected from dust and dirt." In brief, it has become universally recognized that a poor ventilating system is the worst possible handicap to proper sanitation.

Not only may the air intakes bring into the car clouds of dust and germs from the pavement, but the currents of air in the car, resulting from improperly designed ventilation, might even keep in constant circulation within the car all the dust and germs brought in on the feet of the passengers. And where the air intakes are located in the floor of the car it is easy to believe that most of the dust raised from the floor by the movements of the passengers must pass their mouths and nostrils on its way to the foul-air exit.

Of course, the gradual disappearance of the old type of car, where the ventilation was largely dependent upon the frequent opening of the doors at both ends of the car, for entrance and exit of passengers, has complicated the ventilation problem, but it would seem that the cleaning problem has been somewhat simplified by the adoption of some of the new designs. There is probably less dust entering the car, and the air currents within can be more easily controlled as to volume and direction.

Nevertheless, the cleaning of cars, even the most modern ones, is still giving operating departments of street railway companies much food for thought and experiment and, although local conditions are naturally very diversified, opinions as to just what constitutes a " cleaning " are still more widely divergent. With respect to the conditions which confront the official in charge of this department

of operation, there is no doubt that many of those interested still remember an editorial appearing in a technical journal about two years ago which said, in part:

Hercules' assignment to cleanse the Augean stables was a trifling task compared with that of keeping the ordinary street car in absolutely clean and sanitary condition. The vast difficulty of securing this result is not appreciated by the public, which seems to expect that every car should be accompanied by a scavenger as a third member of the crew. A case in point is afforded by the experience of a company which recently answered some complaints about the cleanliness of its rolling stock. It showed that the cars are cleaned and disinfected every night, at a daily cost of 22 to 30 cents per car. In other words, the equivalent of about five fares is required every day merely to free the cars from filth. It is a hard job to keep even an ordinary sitting room free from dust and odd papers. How much harder would it be to do so if such a room were visited every hour by 50 to 100 people of all classes, from bricklayers to bankers, while the room itself was being moved through a dusty or muddy street with doors and windows open? Yet these are exactly the conditions to which a city electric railway car is exposed. Here is a direction in which the public can assist. No matter what care the company exercises, the sanitation of public conveyances would be greatly bettered if the riders did not use the seats for foot rests, the window sills for whittling blocks, and the floors for cuspidors and waste-paper receptacles. If the cars are to remain reasonably free from malicious microbes after they leave the depot in the morning, it is essential that the passengers themselves should be considerate and cleanly during their riding hours.

The general public has undoubtedly formed its opinion of what constitutes a "sanitary" condition in a street car by accepting too freely the definition as implied by the various local ordinances on the subject. With all due respect to the municipal authorities who have framed requirements for such ordinances, it is apparent that they have sought principally to maintain comfortable but insanitary temperatures in winter, with no provision for removing the heated air after it has become vitiated by an unusual crowding of the car. An attempt to comply with such municipal regulations has given complexity to a problem upon which so many practical men have labored.

It is true that some ordinances specify that the cars shall be cleaned at stated periods, but neglect to state how the cleaning shall be done or to limit the thoroughness thereof. Others require the use of disinfectants, but do not enter into the details of their application.

But let us review briefly what is actually done at the present time in some of the principal cities of the United States toward obtaining a sanitary condition in the street cars operated by private corporations. An official of the Capital Traction Co., operating here in the city of Washington, states:

It is our practice to sweep the inside of cars after each trip; to wash the outside and the windows once a week, at the same time wiping off the interior woodwork of the car with a damp cloth. As to ventilation, we have no automatic ventilators. All our cars are equipped with deck sash openers, and con-

ductors are instructed to vary the number of ventilators which are open with the temperature, but under no circumstances to run the car without at least one or two ventilators open on each side.

In New York City we find what is probably one of the extremes of street car sanitation; that is, the system used in the subway cars of that city. Mr. Frank H. Hedley described the method in an address made a few years ago at the American Museum of Natural History. He said that the thick matting on the floor of the cars, which was a trap for diseases of all kinds, had been done away with, and its place taken by hard-maple strips, three-quarters of an inch square and the same distance apart. Every night the floor of every one of the 2,500 subway and elevated cars is sprinkled with a 5 per cent solution of carbolic acid, which is a disinfectant and a destroyer of germs. The floors are then swept clean, and after the dust has settled it is wiped up carefully with cheesecloth instead of being churned up with feather dusters. Every week, and oftener if necessary, the floors are scrubbed with a soft soap containing a very strong solution of alkali. Every month the interiors of the subway cars are cleaned with an oil emulsion, which gathers up all the fine particles of dust, and at least once a year every car is painted, varnished, and oiled, so as to most effectively repel the collection of grime and germs. Every night the straps are cleaned with an acid solution which will kill germs.

But improvements have been made since the adoption of the above method. The Hudson-Manhattan Co. has replaced the wooden slats with water-tight cement floors and the leather straps with enameled iron rods and uprights. The Interborough Co. itself has largely replaced the leather straps with a metal hanger of much more convenient use and restful shape than the leather straps. This new hanger is made of steel tubing covered with porcelain enamel, which is glazed on at 1,800° F. The most valuable feature of this hanger is its absolute cleanliness, as the porcelain coating prevents the absorption of dirt or perspiration. But the company does not rely upon the smooth, nonabsorbent surface of the hangers to keep them germ proof. Every night the handles are immersed in an earthen vessel containing a solution of carbolic acid—a treatment which could not be withstood by straps of animal or vegetable fiber. The hangers do not have to be removed from the tubing, as the vessel is simply lifted up to them. After the hangers have been dipped they are left to dry without any further attention.

On the South Side Elevated Railroad of Chicago a regular inspection of the cars is made on the basis of 1,500 miles, about 25 cars a day being put through the inspection shed, where all cars are cleaned. The body paint is gone over with an emulsion cleaner manufactured by the company, the formula for which was obtained from the Philadelphia Rapid Transit Co. It is applied with scrubbing brushes and

then wiped off with waste. All the windows of all cars are cleaned with whiting and water at each inspection. The floors are also scrubbed and the interior finish rubbed clean. The cleaning process also includes disinfecting with suitable disinfectants. The unit costs for cleaning cars are as follows: Windows, 40.75 cents; sweeping, 6.01 cents; scrubbing, 20.41 cents; outside cleaning with emulsion, $2.34 per car.

The Public Service Railway Co. of New Jersey has adopted a system of cleaning which impresses the writer as being among the most simple on record, and yet productive of results that are as effective and economical as any actually attained by practical methods. The floor and vestibule of every car are swept at least once a day, sometimes several times a day, dependent upon weather conditions, season, and the class of passengers carried. At periods, varying from four to six days, each car is thoroughly washed, inside and out, with a mixture of Columbia oil soap and water. This mixture is made by using about 2½ gallons of oil soap to 40 gallons of water, and 1 pint of this mixture is used with each bucket of water in washing the outside of the car. A stronger mixture or a larger proportion of the soap is used in washing the vestibules and floors, and a slightly weaker mixture for the interior woodwork. This washing with the soap mixture is followed by a thorough flushing with clear water. There is nothing particularly striking or new, nothing elaborate nor impractical, about the above method; in fact, it is probably the most generally adopted plan of any in use, and it does seem that the results are all that can reasonably be demanded.

The methods employed in many other cities might be cited, varying in detail and thoroughness from those given, but a digest of the whole would lead us to believe that a remark that Col. Waring, of New York, once made regarding street cleaning, might be fitly readjusted to suit the street-car problem. He said: "It is easier to keep a clean street clean than it is to clean a dirty one," or words to that effect, and so we may truthfully say: "It is easier and cheaper to keep a clean car clean than it is to clean a dirty one." Frequent cleanings lead toward economy and thoroughness.

Some companies employ mechanical means for cleaning. For instance, the Middlesex & Boston Street Railway Co., in its shops, uses an old eight-bench open car fitted up with a motor-driven air compressor. In addition to blowing out cushions and controllers this equipment is used as a vacuum cleaner by the addition of a simple Y in the piping near the nozzle of the air-delivery line. Attached to one end of the Y is a flexible pipe, terminating in a flat copper nozzle with a quarter inch slot, which is passed over the surface to be cleaned in the manner of an ordinary brush. The stream of air passing the

Y in the delivery pipe establishes a suction after the manner of an injector pump.

The Metropolitan Street Railway Co., of New York, has a car devoted to vacuum cleaning, principally used in connection with the carpets employed on the seats of a large number of cars on the system. This car contains a vacuum cleaning machine complete with motor. Its headquarters are at the main repair shop, but it is sent to the various car houses at regular intervals. Many other companies use vacuum cleaners of varied styles and designs, some using such a cleaner for all the dust collected in the interior of the car.

For the outside cleaning the Illinois traction system, among others, uses a self-feeding brush consisting of an all-bristle, copper-tied brush, to which is attached a cold, drawn-steel tube handle, which is lighter than the ordinary wooden handle. At the other end of the handle is a water valve and a standard hose connection. To use the device the handle is connected to a hose from hot or cold water supply, and the water goes up through the brush on to the object to be cleaned. The valve is arranged to admit just enough water to wet the surface or else enough to thoroughly flush the wood, as may be desired. It is claimed that one man with this brush can clean the entire side of an electric car more quickly, and quite as thoroughly, than two men working in the ordinary way; also that the thorough flushing which the side of the car receives washes away grit and dust in a manner not possible with the usual method, except by scouring, which is detrimental to the interior finish. The flushing is very effective also in cleaning the corners of the windows and the ventilators, which are often passed over by the usual method.

It must not be supposed, however, that all the officials are agreed as to the best method, nor have they given up experimenting with new ones, even in the apparently simple question of washing the outside of a car. Witness the report of the question-box committee, presented at the 1911 convention of the American Electric Railway Association by the Engineering Association. Among others, the box contained this question: "What is the best method of cleaning the outside of a car at a reasonable cost without injuring the varnish?" To which the Washington Water Power Co., of Spokane, replied:

> We know of no method whereby a car can be cleaned at a reasonable cost without injuring the varnish. It must be either a high maintenance for cleaning and a saving of the varnish or a low maintenance for cleaning and injury to the varnish.

But a near neighbor of this company, the British Columbia Electric Railway, in Vancouver, replied:

> We have obtained good results with a soft brush with a tubular handle attached to hose and water supply.

The East St. Louis & Surburban Railway goes at the operation with more vigor:

We scrub with warm water and homemade soft soap. Wash off with cold water and chamois. We believe it does not injure the varnish.

The New York State Railways, of Rochester, differ with the last-mentioned on a question of temperature, as they say:

Wash with clean, cold water and, if necessary, used linseed-oil soap.

Perhaps there is as much difference in varnishes as there appears to be in best methods, but undoubtedly local ideas of thoroughness largely govern the various opinions expressed.

That the subject of mechanical cleaning should be given more attention and study was undoubtedly the idea of the Electric Railway Journal when it voiced the following editorial opinion:

It is somewhat remarkable that, while vacuum and compressed-air machinery is revolutionizing the cleaning of assembly rooms, offices, and residences, many electric railways cling to the car-cleaning methods which were in force during the era of the horse car. This condition seems all the more odd, in view of the fact that some supply of energy for power-driven machinery is almost always available at a car house. It is true that a few companies have adopted certain old railway air compressors, either for compressed-air cleaning alone or for a combination of pressure and vacuum cleaning. But such outfits can not be expected to give the best possible results, partly because they are too small for the work and partly because they were designed for intermittent operation. What is wanted is a continuous-service machine which is capable of exerting such powerful suction that objects as heavy as peanut shells will be drawn out quickly from every nook and cranny of the car, even at a distance of several inches. The cost of cleaning constitutes so large a proportion of the car-maintenance expenses that the application of specialized machinery to it is worthy of careful consideration.

When the question of disinfecting street cars was first discussed, it was undoubtedly with the idea of discovering some preparation or mixture that would not only kill all the germs in the car at the time of its application, but would also render the car uninhabitable for other germs for a reasonable length of time thereafter. Advance of science has proved the impracticability of this idea, and it is now admitted without question that even though a car be as thoroughly disinfected as is possible with any liquid or powdered preparation the first passenger entering after this operation may leave in the car a thriving colony of an entirely new breed of germs. Consequently disinfecting has been entirely abandoned by many companies and only perfunctorily practiced by others. It is even recorded that one company, compelled by municipal ordinance to disinfect its cars, after giving them their periodical cleaning, places small bunches of waste in unseen or hidden corners, saturating this waste with some disinfectant that will be plainly noticeable to the nostrils of the passengers. This may not be a strict compliance with the ordinance, but it undoubtedly satisfies the public.

Probably the only thorough system of disinfecting ever employed is that which has been in use for the past three years on the Prussian State Railways. This consists of placing the entire car in a hermetically sealed tank, reducing the interior pressure to a partial vacuum, elevating the temperature, and then allowing the disinfectant to enter the tank in vapor form. The process requires five hours for each car, which in itself would make the average American operating official protest against such lavish loss of time, and the original cost of apparatus and operating machinery for each tank is over $21,000. It does not promise to ever become very popular among the street railway companies in this country.

The first real steps in advance of the present methods of sanitation will be taken when the designer and builder study the cleaning problem as carefully as they have the heating and ventilating branches, and produce a car free from sharp angles and inaccessible corners, and the space immediately above the floor free from obstructions, such as foot rests and the like.

TRANSPORTATION AND URBAN HEALTH.

BENJAMIN C. MARSH, secretary New York Committee on Congestion of Population, New York City.

Among the hallucinations of the times is the belief that rapid transit alone is adequate to insure healthy living conditions for the wage-earning population of our great cities.

Rapid transit is a waste in the cost of production, and its results are largely dependent upon the proper exercise of the police power of the State.

The establishment of a standard of housing is the first step in securing healthy homes and work places, while measures to bring this standard within the reach of the wage-earning classes are equally essential.

The adequate exercise of the police power of the State to establish hygienic arrangement and standards of cities involves the determination by the local authorities of the height and number of stories of buildings, as well as their cubage, the proportion of lot area that may be occupied, width of courts, etc. With the difference in most cities between central and suburban districts, different building regulations are needed for the outlying sections of cities than the present intensive use of land in the central part seems to render necessary.

Such differentiation in building regulations is essential to a proper determination of transit routes.

RESTRICTIONS ON LOCATING FACTORIES.

Even more important in relation to rapid-transit lines is it that city authorities should have power to prohibit the location of factories in places where their presence would be uneconomic or detrimental to the best interests of the neighborhood. The concentration of large factories, as well as of huge office buildings, in cities seriously complicates transit problems, and this difficulty can be avoided, not by more transit but by preventing undue concentration of offices and factories.

Rapid transit increases land values, because anything which creates demand for land by making it accessible has this effect. Land, however, must be not only accessible and its use carefully regulated, but available; that is, cheap. Since the actual effect of transit is to increase the cost of land, just the reverse of the effect desired, some counteracting influence must be sought. The most logical and equitable method of bringing land into the market at low prices and of preventing that land speculation which is the bane of most cities is to tax land values heavily and to exempt buildings wholly from taxation, or, at least, to tax them at a much lower rate than land is taxed.

Our failure to untax buildings is the most important single cause of congestion, high rents, and unhealthy tenements. American cities are beginning to realize this and to urge this sane method of making rapid transit conserve the health of the community instead of serve the cupidity of landowners.

When we stop penalizing the construction of healthy buildings and put more taxes upon land values we shall make it less profitable to hold land out of use for speculative increase in value. We shall thereby make all land in a city, as it will become accessible, through rapid transit and the distribution of factories and more available for healthy dwellings and other useful purposes.

WEDNESDAY MORNING, SEPTEMBER 25, 1912.

AN ATTEMPT AT COOPERATION IN RAILWAY SANITATION.

E. R. Kelley, M. D., State Commissioner of Health, Seattle, Wash.

The subject of railway sanitation has received much attention in the past decade.

Several years ago Bracken could say that an address on railway sanitation in the United States was very similar to the celebrated treatise on snakes in Ireland, which began: "There are no snakes in Ireland."

To-day this charge can scarcely be made. Some may affirm that railway sanitation in fact is still a negligible quantity in this country; but, at any rate, attempts at railway sanitation have been made in abundance, and some real advances have been accomplished.

That the subject is still in a far from satisfactory condition, even in sections where most has been done, is very apparent to the traveling public, the sanitarian, and to the railroad officials themselves.

There are many causes for this state of affairs in railroad sanitation or insanitation, ranging all the way from lack of adequate power on the part of health officials, to lack of development of any "center of sanitation" in the cerebral convolutions of many of our practical railroad magnates and operative heads. For this last they are not to be blamed, perhaps, as there is nothing in their practical education as railroad men which would tend to develop sanitary connoisseurs.

Disregarding many other obvious reasons for the lagging of the steps of the goddess Hygeia in the domain of transportation, I believe the greatest drawback to advance in the United States to be simply this: That our railroad empires do not coincide with our State lines.

One of the pioneers in the cause of railway sanitation delivered an address at another international congress a few years since, in which he reviewed the status of railway sanitation throughout the United States. He drew attention to the fact that the subject is essentially an interstate problem and that the most obvious and rational manner of attacking it would be through Federal control, if only such could be obtained. He also made this statement:

> It might be possible for State sanitary authorities, in conference or through a committee and acting in conjunction with practical railroad operators, to formulate certain regulations that would be applicable to the entire country. * * *

This idea took root in the minds of several sanitarians and railroad officials of the Northwest, and from that time on the possibility of attaining to a condition of uniformity in the sanitary regulations of common carriers in that portion of the country has always been considered.

The Northwest probably presents a peculiarly favorable field for such an experiment in cooperative regulation, from the fact that in most of these States the right of their State boards of health to control sanitary matters through regulations has never been questioned and is based on fundamental statutes.

In Washington the right of the State board of health to promulgate and enforce regulations in all matters intrusted to its jurisdiction by the legislature is guaranteed by a provision of the State constitution. In North Dakota control of railway sanitation has already been vested, by statute, in the State board of health. In Montana the power of the State board of health to make and enfore sanitary regulations for common carriers has been upheld by the courts. In Oregon there is specific statutory authority for the State board of health to enforce regulations relative to the transmission of contagious diseases by common carriers. Idaho has granted to its State board of health what is perhaps the most sweeping general authorization for the promulgation of sanitary regulations of any State in the Union. Of all the Northwest States, in Minnesota alone, which State was a pioneer in railway sanitation, has the power to enforce these regulations been denied by the courts.

In all the States just mentioned, except Idaho, in addition to their boards of health, there are public-service or railroad commissions which are given very broad powers of control over railroads and other common carriers.

So, on the one hand, we have a chain of six contiguous States which, as a whole, have invested their boards of health with very broad legislative powers. In this same region, on the other hand, we have four of the great railroad systems of the country which, between them, own or control nearly every mile of railroad track in this vast stretch of territory, 2,000 miles in length and from 300 to 700 miles in width.

Two of these systems, the Northern Pacific and the Great Northern, have all their terminals in this region, while the other two, the Milwaukee and the Harriman systems, have a very large proportion of their trackage located in these same States. Through this territory fast through trains move continually.

Let us imagine ourselves starting from St. Paul, on our way to Portland, Ore., on the 1st day of January, 1912, and note under what sanitary regulations we are living during our dash across the country.

First, in the matter of drinking cup:

In Minnesota, North Dakota, and Montana the common drinking cup is with us, but in Idaho it disappears, only to reappear as if by magic when the train leaves Idaho and enters Washington, and to disappear again as the train pulls across the Columbia into Oregon. And, if we happen to be in a Pullman car, the drinking cup plays a game of hide and seek all the while. In all of the States it is concealed, but in most of them it is only up behind the towels, or in the locker inclosing the water tank, and the porter will get it cheerfully for you upon request. But in Idaho and Oregon it retreats behind lock and key.

Then in the matter of disinfection:

In Minnesota the State board of health requirement says that fumigation shall be done at least once every two months. Minnesota regulations not being enforceable, it is difficult to say just when the car would be disinfected if it remained continually in Minnesota. But ours being a through train, we soon arrive in North Dakota, where the law requires the car to be first cleaned and then disinfected at least once each month; and it is done, as note the little sign tacked up in each car to reassure the passenger as to just where and when and how it was done last. But soon we are in Montana. If the car could only skip North Dakota in some way, disinfection would not be such a recurrent bore in the life of a sleeping car, for the Montana rules require a sleeping car to be first fumigated and then cleaned, reversing the North Dakota order, but only once in two months. Then in another 24 hours the car will escape from Montana into the territory of Idaho, Washington, and Oregon, where a sleeping car might live on to a green old age and never have to submit to the indignity of a formaldehyde vapor bath, so far as the health officials are concerned, unless it were so unfortunate as to temporarily harbor a contagious disease and be caught in the act by a local health officer.

Then in the matter of sweeping:

In Minnesota the State board of health has prohibited dry sweeping in the cars while in transit, but it is optional upon the part of the porter whether he chooses to follow the regulation or not. In North Dakota nothing is said about the sweeping, so the chances are that the porter will raise about as much dust as he sees fit. But when the car reaches Montana dry sweeping ceases. In this State porters have been known to be arrested and forcibly removed from these cars just for kicking up a dust. But anon we are in Idaho and in Washington again, and once more there interposes no legal barrier to the free and unrestricted circulation of dry dust in the faces of the passengers by the energetic wielding of the broom.

There is the matter of spittoons. In Minnesota and Montana the number, style, and frequency of cleaning of spittoons is carefully

specified. In Montana the health officials require the cleaning of these humble but essential articles of American social life once each day. In North Dakota, while the law is silent on this particular point, we might conclude that a monthly cleaning would cover the legal requirements, this being the minimum period of frequency which the statute would seem to contemplate for all kinds of cleaning on railway cars, from spittoons up. The sovereign States of Idaho, Washington, and Oregon are apparently indifferent; at any rate, they are discreetly silent on the spittoon question.

But enough! True, the list is far from exhausted. We might go on and point out many other particulars in which these States differ or are silent relative to the same details of car sanitation. It is not strange, with the matter in such confusion, that practical railroad officials are often inclined to make light of sanitary regulations and to do very little toward enforcing them on their own initiative. They are in a better position than anyone else to realize the impossibility of effectively training hundreds of porters, brakemen, and waiters, to say nothing of the different employees along the right of way, so that all of them will accurately observe the half dozen different sets of sanitary regulations at the proper times and places, all during the single run.

Nevertheless, railroad officials realize better each year the advantage, from a business standpoint, of having their roads as free as possible from objectionable sanitary features for the better protection of their own employees as well as of the traveling public.

Therefore, all of the railroad systems invited sent representatives of their operative departments to meet with representatives of the Northwest States Boards of Health and Railroad Commissioners in Helena, Mont., on March 8 of this year.

The Pullman Co., that anomalous factor in the modern railroad world, which might perhaps be described, by slightly modifying the old Latin phrase, as being imperium inter imperia, was also represented by its superintendent of sanitation.

The purpose of the conference—to endeavor to draw up a uniform set of sanitary regulations—met with the most enthusiastic approval from all. But the first few minutes' discussion demonstrated that it would not be by any means an easy matter to reconcile and harmonize the conflicting points of view. However, a spirit of mutual concession and a fixed determination to allow nothing to become incorporated in the new regulations that was not absolutely practical and reasonable, carried the conference through several very hotly debated points, and resulted in the final shaping of a set of regulations which are apparently satisfactory to all concerned—railroads, railroad commissions, and State boards of health.

To get the subject in its entirety before the conference, the following classification of railroad sanitation was suggested, so that the conference might decide definitely just what phases of the subject it would consider:

Section 1. Sanitation of the rolling stock: (*a*) Sanitation of passenger cars; (*b*) sanitation of cars other than passenger cars.

Section 2. Sanitation of railway improved property: (*a*) Station and grounds; (*b*) repair shops, roundhouses, freight sheds; (*c*) railroad eating houses; (*d*) other buildings belonging to railways.

Section 3. Sanitation of the right of way: (*a*) Track pollution in general; (*b*) pollution of watersheds by right of way; (*c*) sanitation of tracks and yards at stations; (*d*) sanitation of bridges to prevent pollution of streams.

Section 4. Sanitation of railway camps.

Section 5. The sources and handling of food and drink.

After some general discussion, it was decided to limit the scope of the conference chiefly to the sanitation of the passenger car, and, to a slight extent, the sanitation of railroad stations and camps, and of the water and food used by common carriers, leaving all the subjects coming under right of way, and the bulk of those under improved property, camps, and food products, to later gatherings.

The regulations, as finally adopted, are appended, but as there is nothing new or revolutionary in their subject matter, I have not felt it advisable to review them in detail, the point of this paper being, not so much what was done on this occasion as how it was done.

The peculiar feature of these regulations, other than their being uniform for the States interested, lies in the fact that it is the intention that each of the railroad systems involved shall adopt them as its own regulations, and require its employees to observe them, not simply as State regulations, but as a part of the rules of the road.

Just what the future of these rules will be is not entirely certain, but, as far as I know, they have now been ratified by all the State boards of health, and have been favorably received by the railroads. In the near future we expect to get together again in conference, adjust minor differences, and then promulgate the rules all over the Northwest.

A few general observations may be of interest:

1. The value of having practical operative officials at a railroad sanitation conference can not be overestimated. These men can frequently point out practical obstacles to schemes that from a sanitarian's point of view are flawless. As an example:

One of the points carefully discussed was the impossibility of rendering ice, as it is supplied to passenger trains, entirely free from accidental bacterial contamination. This naturally led to the suggestion, Why not have coolers so constructed that the ice does not come into actual contact with the water? It

was admitted by the railroad officials that this might be worked out gradually by having such a type of cooler installed in the new passenger cars as they came into service. But the representative of one of the roads stated that his company at one time spent several thousands of dollars in installing just such a system for cooling the water used in its dining cars, only to abandon it on account of the incessant demand from the public for ice in the drinking glasses.

2. The railroad officials of the country generally still need a great deal of education before they can begin to realize the practical value of sanitation to themselves. For instance: The operative officials at first unanimously objected to any consideration of the subject of the sanitation of railway improved property, basing their objection on the ground that the improved property is located in cities, towns, villages, or in the open country, and that any piece of improved property owned and controlled by a common carrier corporation should be subject to the same sanitary standards that are imposed upon any other improved property of similar character in the particular city, town, village, or countryside in which each particular piece of railroad property chances to be.

Now, if the correct business attitude of a railroad corporation toward sanitation be that of a schoolboy toward a task—to do just so much as is absolutely required, and no more—this stand is fully justified. If the correct business attitude of a railroad corporation toward sanitation be to regard it as the "outward manifestation of the workings of an inward grace," to endeavor by the aid of sanitary science to make the surroundings under which their employees work and under which the traveling public temporarily live as sanitary and as healthful as they can be made, then it should be something entirely different.

The attitude of the railroad official should be not how slovenly and filthy can that depot or toilet or roundhouse be allowed to get and still avoid being proceeded against as a nuisance, but rather just how good an example in sanitary matters can our buildings and grounds set, in whatever community they may be.

Emphasis has been laid upon the difference in mental effect that the sanitary surroundings of a station in which one has to make an unavoidably long wait for a delayed train will inevitably produce. But I maintain this does not by any means cover all the esthetic and psychological, to say nothing of the scientific, reasons why it would be good business for railroads to pay very careful attention to both the sanitary and esthetic features of their improved property. For example: Throughout the West the keynote of railroad success is to attract colonists to settle in the territory tributary to the railroad. Will anyone deny that probably 25 per cent of the net first impressions of any section of settled country upon a traveler or prospective settler is produced by the appearance of the railway's own property?

3. Another very important point in regard to railway sanitation is that the peculiar exigencies of railroad transportation will render the satisfactory solution of some sanitary problems a laborious affair. And I believe that some of them will only be solved by utilizing the "laboratory method," as applied to practical conditions, and by gradually experimenting to improve upon the present status.

For instance, the limitations of space and the necessity of going at a high rate of speed render such questions as ventilation, heating, dust prevention, and abolishment of smoke nuisance very different problems from what they are in dwellings, stores, or even on steamboats. Perhaps nowhere does this fact become so apparent as in the question of sewage disposal, both from moving trains and from cars standing at stations.

There are already several devices for sewage disposal on trains, but it is going to take some years yet to convince operative officials that track pollution is a problem that must be solved. The ultimate solution of such problems as these will need the hearty cooperation of the sanitarian, the structural engineer, and the railroad official.

4. Another remarkable condition in the domain of railway sanitation, and the more remarkable when we contemplate the proved economic gain of practical, well-applied sanitation, is the fact that, with very few exceptions, there does not seem to be any conception on the part of the average railroad of the possibility of utilizing its extensive corps of surgeons as a body of inspecting sanitarians.

The average railroad surgeon performs his duties without giving the slightest attention to sanitation; neither, apparently, does the average company expect him to do so. Yet, I believe that, with a few years' training, a reasonable degree of authority, and a very modest remuneration for the performance of such extra duties, the railway surgeons of America, backed by a practical sanitarian at headquarters, with power to carry out practical sanitary improvements, could revolutionize the sanitary aspects of American railroading, much to the physical, economic, and moral gain of the public and the railroads themselves.

5. Another point that was brought out forcibly by the railroad officials at Helena related to the degree of detail that should be specified in printed regulations. They pointed out that, not infrequently, to arrive most successfully at the desired end—as, for instance, in the matter of car cleaning—it would be far better not to be tied down too rigidly in the matter of details of execution. I believe that this objection is well taken and that it holds good in many other matters besides railroading. In general, it would seem wise for boards of health or legislatures, when passing sanitary regulations or statutes, for whose execution others are responsible, to follow this rule. When the actual manner and form of the act leading to the desired result

is in itself of first-grade sanitary importance, as in formaldehyde gas fumigation, for instance, specify in detail; otherwise, merely set a standard of expected sanitary efficiency as to results, and leave the details of the accomplishment of such results in the hands of those immediately responsible.

CONCLUSIONS.

1. In railway sanitation uniformity of standards is desirable.
2. In default of Federal regulation, it would seem wise for States having similar environment, as well as railway systems in common, to endeavor to harmonize their railway sanitary requirements.
3. This can best be done by meeting in conference.
4. There is great advantage in enlisting the sincere cooperation of the railway officials themselves by inviting them to participate fully in such conferences.

APPENDIX.

DRAFT OF REGULATIONS RELATIVE TO RAILROAD SANITATION ADOPTED BY THE NORTHWESTERN SANITATION ASSOCIATION AT A CONFERENCE HELD IN HELENA, MONT., MARCH 8 AND 9, 1912.

These regulations were officially adopted by the Washington State Board of Health as the regulations governing railroad sanitation in this State, at a special meeting of the board held in Seattle on April 10, 1912, with the amendments specified under the subject of "railroad sanitation."

REGULATION 1. No person having reason to believe that he or she is suffering from any contagious or infectious disease, or who has been exposed to such disease, shall enter, nor shall any person permit anyone under his or her care so infected or exposed to enter any public conveyance or common carrier.

REGULATION 2. All conductors of railroad trains and street cars and captains of boats are required to observe all passengers on their train, car, or boat, and if they have any reason to suspect that any such passenger is suffering from any contagious or infectious disease, they shall immediately notify the nearest health officer or company physician located on their route, by the most direct and most speedy means possible, in their belief, and such health officer or company physician must meet such railroad train at the station or such street car or boat at the nearest possible point, and make a thorough examination of such person and determine whether such disease exists.

REGULATION 3. When the health officer or physician notified as provided in regulation 2 shall find any person in a car, boat, or other public conveyance to be afflicted with smallpox, diphtheria, scarlet fever, or other quarantinable disease, the car, boat, or other public conveyance shall be turned over to the health officer or physician, who shall treat such conveyance as infected premises. When in the judgment of the health officer or physician the case is in such early stage of development that other passengers are not affected, the patient shall be removed from the conveyance and it shall be allowed to proceed. If the health officer or physician shall deem that the exposure is such as to have infected the other passengers, he shall call upon the person in charge to remove infected conveyance from service at the first station where suitable accommodations can be secured and such health officer or physician shall notify the health officer in whose jurisdiction the infected conveyance is left.

REGULATION 4. No person shall spit on the floor, furnishings, or equipment of any public conveyance, eating room, depot, depot platform, waiting room, deck, or wharf. Each common carrier is hereby required to post and display in each day coach, smoking compartment, or boat a placard in form as follows:

For cars: Spitting or throwing of refuse on the floor, furnishings, or vestibule of this car is prohibited by law.

Waiting rooms, eating rooms, toilets: Spitting or throwing of refuse on the floor or furnishings of this room is prohibited by law.

Boats: Spitting or throwing of refuse on the deck, floors or furnishings, or toilet rooms of this boat is prohibited by law.

REGULATION 5. All general waiting rooms and smoking rooms must be provided with one or more spittoons, which must be placed on the floor. Water must be kept in all such spittoons.

REGULATION 6. Each sleeping car shall be furnished with 1 spittoon for each section or compartment. Each smoking compartment in day coaches, chair, parlor, and sleeping cars must be furnished with at least 2 spittoons. Each smoking car shall be provided with at least 12 spittoons. Each combination smoking car shall be provided with at least 6 spittoons. Each boat carrying passengers must provide 1 or more spittoons for each stateroom and general smoking saloon.

REGULATION 7. The drinking water and ice supply used in stations and on public conveyances must contain no ingredients deleterious to health. In the construction of new equipment all receptacles for drinking water should be so constructed that they can not be opened readily by anyone except those having charge of same. Nothing but ice and water shall be placed in the receptacle used for the storage of drinking water. The receptacle for drinking water shall be kept thoroughly clean at all times and shall be drained and flushed at route terminals.

When a water-borne disease has developed in epidemic form in a municipality, water from such place for car tanks shall not be used without the approval of the State board of health.

REGULATION 8. The use of the common public drinking cup is prohibited in all public conveyances and in waiting rooms.

REGULATION 9. All public conveyances, including toilet rooms therein, must be kept in a reasonably clean condition at all times. Dry sweeping and dusting of occupied conveyances is strictly prohibited.

REGULATION 10. At cleaning terminals all passenger equipment shall be thoroughly cleaned, and after such cleaning the hoppers, urinals, and toilet floors shall be mopped with a 1 or 2 per cent solution of formaldehyde.

REGULATION 11. Upon arrvial at cleanng terminals, sleeping cars shall be cleaned as follows:

The windows, doors, and ventilators shall be opened, the upper berths let down, the seat bottoms and backs lifted out, the mattresses, blankets, pillows, curtains, etc., loosely arranged for airing. If the weather permits, the removable articles mentioned above shall be taken out of the car, dusted and aired in the open, and exposed to the sunlight for a time. The rest of the cleaning of the car shall be carried out as directed for day coaches under regulation 10.

REGULATION 12. Sleeping cars shall be fumigated at least once every two months, and after the car is known to have carried any infectious disease. Fumigation shall be carried out before the carpets have been removed or the cleaning of the car begun, and record posted in car showing where and when done. Preparation for fumigation shall be as follows:

Close all outside doors, windows, deck sash and ventilators. Arrange one or more windows on each side of the car so that they can be opened from

the outside to avoid the necessity of entering the car while the formaldehyde fumes are strong. Open all interior doors. Pull the seats forward and loosen the pillows in the pillow boxes. Open the upper berths and lay the head boards across the seats so that one corner will rest upon the seat arm. Lay the lower mattresses on the head boards with the middle arched upward, the ends being pushed together. Raise the curtain poles and hang the curtains near the end by a single hook. Throw the blankets over the curtain poles, making as few folds or thicknesses of the blanket as possible. Arch the upper mattresses in the upper berths.

Fumigation shall be carried out along the lines approved by the State board of health. After the car has been fumigated it must remain closed for a period of at least three hours, after which time the doors and windows shall be opened as soon as possible. On rainy or damp days the car need not be kept closed after fumigation for a longer period than one hour.

Regulation 13. Porters shall not sleep in sleeping cars unless a special compartment in the sleeper and special bedding are provided for their use by the companies operating same.

Regulation 14. In all public conveyances the food boxes, refrigerators, lockers, drawers, and cupboards shall be kept thoroughly sweet and clean at all times.

Regulation 15. The common roller towel shall be abolished on all common carriers and in waiting rooms.

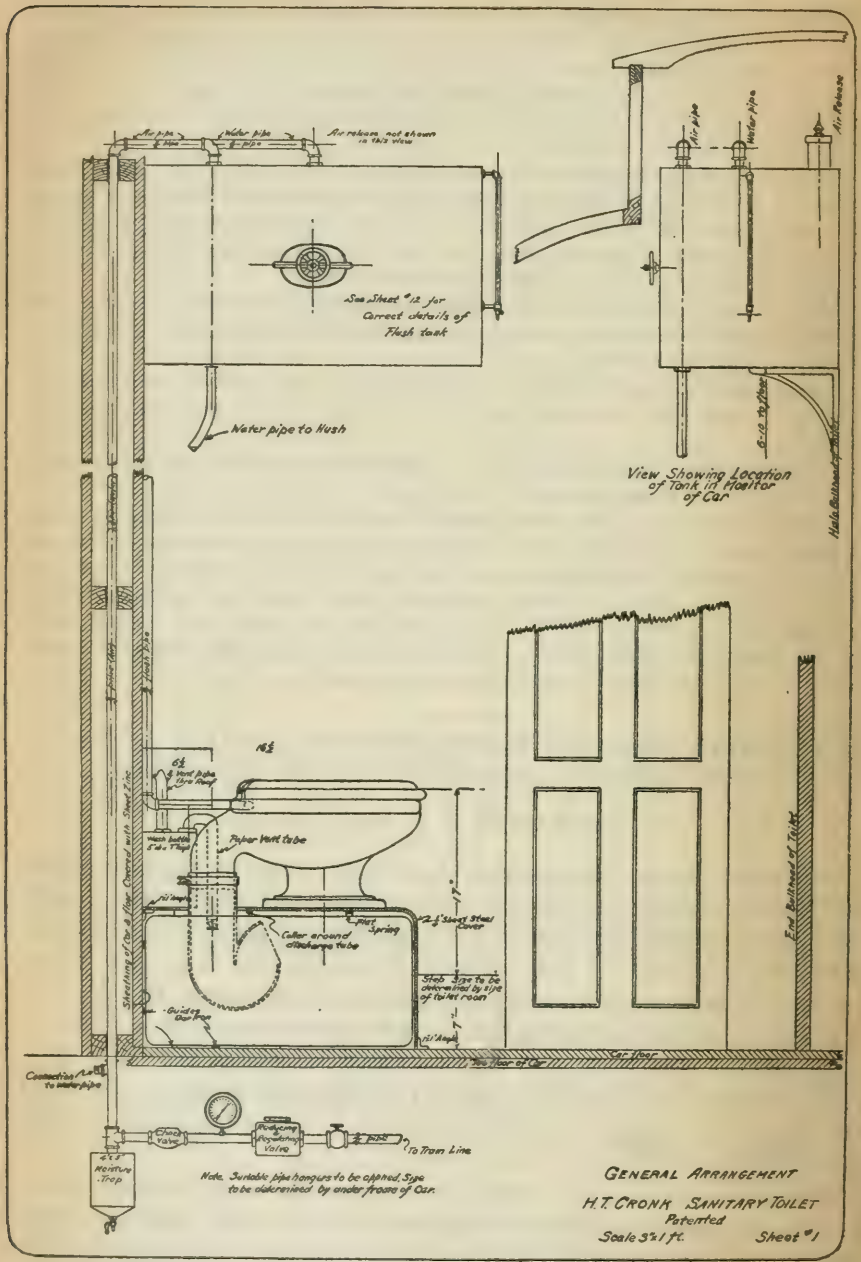
Regulation 16. All toilet rooms, water closets, urinals, and toilet appliances in stations shall be cleaned daily, and when vaults or surface receptacles are used in connection with closets at stations, such vaults or surface receptacles shall receive at least a weekly treatment with fresh lime or other agent approved by a board of health. All closets shall be locked and the key kept by the agents, who shall deliver it to the patrons on request. There shall be notice "Key at the office" posted on the closet door.

THE REMEDY FOR THE PREVENTION OF DISEASES COMMUNICATED THROUGH TOILETS IN USE ON RAILROADS.

H. Taylor Cronk, M. D., New York City.

From the very earliest periods the recognition of the dissemination of disease from the excreta and offal of man and animal was considered of so much importance that measures to prevent this disease communicability have been adopted from time to time as enlightenment, education, and science progressed. The ancient Mosaic laws were founded on preventive rather than curative science, and had it not been for the foresight of those early observers for the future preservation of life through laws of sanitary government, we could not enjoy the comforts and advancement in social intercourse which we do to-day.

In the early development of our country, the frontiersman, when in encampment, required the company cook to stand near the mess camp and throw a stone as far as possible to mark the place for depositing refuse and excreta, and woe betide the comrade who disobeyed this edict!


Air pipe
Water pipe
Air release, not shown in this view
See Sheet #12 for Correct details of Flush tank
Water pipe to flush
View Showing Location of Tank in Monitor of Car
Air pipe
Water pipe
Air Release
End Bulkhead of Toilet
Paper Vent tube
Outer around discharge tube
Guide for Pan
Slab Size to be determined by size of toilet room
Car floor
Connection to water pipe
Check Valve
Reducing Globe Valve
To Train Line
Moisture Trap
Note. Suitable pipe hangers to be applied. Size to be determined by under frame of Car.
GENERAL ARRANGEMENT
H. T. CRONK SANITARY TOILET
Patented
Scale 3"=1 ft.
Sheet #1

Following these necessary and compulsory regulations, we have become accustomed to the easily adapted facilities commerce and competition have afforded, until at last we demand the immediate use of, and appropriate for our personal comfort or protection, any device as soon as invented, except those for the prevention of disease; for in this we go on regardless of the offense we are causing others. To-day the disregard for the governing power of sanitary laws, and selfishness, have, except in rare instances, permitted the companies trafficking in human transportation to more or less neglect sanitation. This is, in part, due to the facilities provided, and, in part, to the filthy habits of some of the traveling public.

One great problem our transportation companies have had to contend with is the toilet systems of public conveyances on land and water. Of the many devices experimented with, few are of sufficient value to be considered, either because of interference in car or boat construction, or, more often, impracticability. To-day our transportation palaces are so burdened with equipment that scant room is available, and, unfortunately, little consideration is given to this necessary sanitation.

It has been said: "Where there's a will, there's a way." An appliance has been invented that will meet the laws of health, in preventing the spread of disease through the indiscriminate scattering along our highways of disease germs contained in waste, refuse, and offal; and, while rendering innocuous such material, will also retain it in a practically sealed container until such time as a proper and final disposal can be made.

This invention will not interfere with car equipment; it will cause but little change in the present construction, and does not detract from the appearance of the conveyance.

In operation and construction it resembles an up-to-date convenience, such as is used in modern homes and hotels, with their flushing systems.

The present obnoxious odors of car toilets will be abolished as far as means to prevent them can be provided. They will be noticeable only when some willful or unnecessarily careless person defiles the toilet; because all gases and odors from the retaining tanks can escape only through a disinfecting and deodorizing arrangement.

The bowl is so constructed that the excrement will fall directly into the antiseptic fluid (unless through the carelessness of the user); after flushing with an antiseptic water, the excreta is then received in a retaining tank.

The tube connection with the bowl makes a perfectly water-sealed trap and prevents any noxious odors from returning to the toilet room. It is fastened to the outlet of the bowl by a device which tightly binds and supports it.

This tube extends through a gasket in the main tank, with an arrangement so constructed that no gas can escape and enter the car. The gasket is pivotally hinged, so that the introduction of the trap can be easily accomplished.

The receiving or retaining tank is preferably made oblong with an hermetically sealed door or lid on the end or top as occasion may demand, and an air-tight gasket upon the top, through which the trap or connecting tube and vent pipe extend.

These two tanks are retained in a metallic-lined compartment, which is within the car body, and prevents possible contamination through careless handling. They are kept in place by suitable devices that prevent the movement of the tanks in the car while in motion.

The gases and air that must necessarily be condensed within the receiving tank in operation will pass out through the vent pipe to a wash-bottle device, where these gases pass through an antiseptic material before being discharged into the air above the car roof.

The inner compartment of the receiving or main tank is fitted with baffle plates. Material dropped into this inner tank will be retained unless it becomes fluid or is dissolved by the antiseptics.

The door of the compartment that holds the receiving tanks can be opened either to the left or the right, upward or downward, or sliding, as convenience or necessity may require.

The water used for flushing is antisepticized and will be retained in a third tank, located either in the monitor of the car or in some space near the floor. It will be used in connection with the air pressure from the train service or a special tank carrying compressed antiseptic gases, which will impregnate the water as well as afford sufficient pressure for flushing purposes.

The water-supply tank will be filled from a pipe underneath the car, which can be connected with any hydrant, and will also connect with the train-pipe air service, which keeps the water under a predetermined pressure, unless prohibited by companies controlling present systems of air supply.

An automatic device prevents overfilling of this tank, and, when empty, the exit of the air under pressure.

This supply tank is provided with a water gauge, so that the porter may determine how much water is in it; which, in turn, will give him a reasonable knowledge of the amount of waste material in the receiving tank.

There is also provided upon the water-supply tank an inlet, whereby the antiseptic can be supplied at necessary intervals. When this material is introduced into the tank, the movement of the train will thoroughly mix the antiseptic with water.

The air pipe that supplies the tank has attached to it a condensing or drip basin, a check valve, a pressure regulator, and a cut-off valve. The reasons for their use can be readily understood.

A basin can be introduced into the toilet room, where the water supply will be the same as for flushing, in case occupants desire to wash their hands.

OPERATION.

The air-pressure valve is closed under the car. The man in the car will open the antiseptic inlet, and put in the quantity necessary. He will go into the toilet, unfasten the band that holds the trap or connecting tube in position, and push this trap down into the inner tank.

The man outside the car will open the compartment door, pull out the retaining tank, and, when the gasket is exposed, will put the cover over this, to prevent the escape of material from any slopping, through carelessness in handling.

This tank is removed to the disposal plant, and a clean tank is introduced into the compartment.

The connecting tube or trap, which should previously be placed in position in the new tank, will be drawn up through the opening in the floor, fastened with the clamping band to the bowl, and the air-pipe vent to the gas-vent wash bottle.

The outer door will then be securely fastened.

Connection will be made with the hydrant, which will fill the water-supply tank; when that is filled (which can be determined by the water gauge) the water-pipe valve will be closed, and the train air-pipe service valve will be opened.

DISPOSAL OF THE FLUID.

When this tank reaches the disposal plant, and the lid is removed, the tank will be introduced into a compartment, which will then be sealed, and live steam turned into the receiving tank. This thoroughly disposes of any sources of infection that may have escaped the action of the antiseptic. The tank is then removed from the disposal-plant compartment.

The sealing device or end cover is partly removed from the tank, and the fluids are allowed to escape in the sewer.

The inner tank and splash-plate combination is then drawn out on a cradle, and tipped in such a position that the contents can be washed with water into the sewer. The paper and trap will be caught on a grating, or sieve, and then burned.

As soon as each tank becomes dry, a fresh connecting tube or trap will be introduced into it, tightly clamped with the gasket, the tank

door securely fastened, and the tank will then be ready for future service.

The car cleaners should have no difficulty in washing around the outlet of the bowl and the opening in the floor, as they are easily accessible; and as nothing infectious will remain there will be no chance of contagion.

The metal lining of the compartment is so constructed that it can be washed out with steam or scalding water, or antiseptics, at any time when the receiving tanks are removed.

If the outer door of the car is constructed so that it will slide into the framework of the car, in order to prevent the liability of infection there, a fibrous material strip, saturated with an antiseptic, can be placed so that it will press against the inner side of the door, and, in its movement from its fixed position, will thoroughly saturate that side.

It is not our purpose to dictate what antiseptic should be employed, but would suggest that the one so employed should be inexpensive, nonvolatile, very powerful, and noncorrosive.

BRIEF.

Upper tank: To be filled from outside underbody frame of car; all piping open or concealed, as desired.

Flush tank: Operated by air pressure; saves amount of water necessary for flushing.

In operation: Lever or push-button flushing system, as now in general use, after each occupancy.

Glass gauge: Indicates approximately the amount of water discharged from flushing tank; hence, approximate amount in retaining tank.

Removal operation: Employee unfastens binding band on trap; pushes trap down into receiving tank; tank removed.

Clean tank: Introduced into compartment; new trap brought up; fastened to bowl outlet. Meantime, flushing tank filled and disinfectant introduced. Compressed-air tank filled.

Toilet ready for further occupancy.

A few weeks ago a very pertinent question was raised: That, in the consideration of the adoption of some mechanical means intended to conserve health, prevent infection, and at the same time to not inflict upon our passenger-carrying conveyances prohibitive burdens, due regard must be had for the rights of the public, the rights of the passengers, and the rights of transportation companies. Considering these in order:

Rights of the general public.—The general public will be immeasurably benefited and protected, as they will be no longer subjected to the constant menace of germs and filth spread along the

tracks and polluting the streams which are tributary to water supplies, nor will they be affected by the infected dust stirred up by the motion of passing trains, and blown into car windows, ventilating devices, dining cars, station dining rooms, or near-by houses. This device will prevent the common practice of defiling our station platforms in smaller cities, and highway crossings, which is sufficient to cause us to look with digust every time an approaching train is seen.

Rights of the passengers.—The traveling public will be provided with a thoroughly sanitary toilet, where the flushing water is first treated with an antiseptic solution; the bowl, of special design, will retain sufficient antisepticized water, so that all discharges will come into immediate contact with it, rendering them inodorous and innocuous. They will have the privilege of access at all hours, whether crossing watersheds, rights of way, or in stations. They will be greatly benefited by this convenience, which will prevent the distress and well-known sickness due to the so-called "locked doors." Especially is this true in the case of aged travelers, invalids, and children.

Rights of transportation companies.—All railroad officials traveling in trains and private cars, as well as train crews, section gangs, and operating employees, will be no longer subjected to the menace arising from the pollution referred to. Our mail cars, constructed under Government supervision, have, in some instances, water-flush closets; others none at all. Now the question, Can any State, municipal, or private water supply prevent our mail clerks from polluting these water supplies? And, furthermore, every piece of mail matter is more or less bathed in infected dust which we in turn handle.

Then what conveniences have our express messengers, freight train crews, and section gangs, and are they not as much or more liable to directly infect our water supplies?

The only possible objection, therefore, which the railroads can put forth is the item of expense.

And when we consider that an ordinary steel passenger coach costs from $17,000 to $19,000, and the Pullman steel cars $25,000 and more, it seems to me that an additional cost of a few hundred dollars could hardly be considered of any moment in view of the terrible loss of life every year by these water-borne diseases. The New York Tribune of February 11, 1912, published a three-column article purporting to quote Surg. Gen. Torney, of the United States Army, as stating "that there were 500,000 cases of typhoid fever in this country every year, with one death in every seven, and conservatively costing the people $350,000,000 per annum." Assuming it would take six years to have universally introduced some such device as I have outlined, that would mean that during that period 3,000,000 would have typhoid, one-seventh dying, and the people spending $2,100,000,000.

By 1917–18, as I understand, every passenger car in this country must be made of steel. The expense of alterations after the car is built might amount to two or three hundred dollars. This would be saved if such a device were installed during the process of building.

While a number of remedies for this evil have in the past 10 or 20 years been devised and patented at Washington, there has never yet been anything thoroughly practical and sanitary, and therefore while some of the railroads have been fully cognizant of this menace to health from the spread of excreta on the roadbeds and rights of way, they can not fairly be held accountable if no proper remedy was offered. This device which I have described has been examined by some State health officials, by inspectors of public-utilities commissions, as well as a few railroad officials, and all have expressed their admiration for it, stating that in their opinion it covered every sanitary aspect desired. The same may be said of some large manufacturing concerns who have been approached regarding the manufacture of parts. This being so, what possible excuse can there be on the part of the railroads for their delaying longer the adoption of some such device, whosever it may be or whatever it is, so long as it meets the requirements of the health authorities and is deemed simple and practicable?

As you all well know, this matter has now been agitated for years. Prof. Sedgwick, whose able address we have had the pleasure of listening to, delivered an address on this subject in November, 1899, 13 years ago, before the New England Railroad Club in Boston. Prof. Paul B. Barringer, now president of the Virginia Polytechnic Institute, read an address on similar lines, entitled "An unappreciated source of typhoid infection," at the annual meeting of the Virginia Medical Society at Roanoke, Va., in October, 1903, nine years ago.

Dr. C. P. Wertenbaker, surgeon, Public Health Service, read an article entitled "Railway sanitation" before the Association of Surgeons of the Norfolk & Western Railroad at Richmond, Va., in, I think, 1911, and undoubtedly other eminent sanitarians have taken up this subject.

It would seem most likely, notwithstanding all the arguments advanced, that the railroads will never voluntarily take action. If so, the remedy can be applied only through the health authorities, and the recommendation of this congress would have a most potent influence upon our legislators and the public.

HYGIÈNE DU SERVICE DES TRANSPORTS EN COMMUN.

Dr. Leopold Melis, Médecin principal de 1re classe, attaché à l'Inspection Général du Service de Santé de l'Armée.

En ma qualité de délégué du Département des Chemins de Fer de l'État Belge, j'apporte quelques renseignements sur ce qui se fait dans mon pays en matière de désinfection des habitations et des locaux utilisés par les employés et agents, ainsi que des wagons servant au transport des voyaguers. J'ajouterai ensuite quelques mots au sujet de perfectionnements qui, à mon avis, devraient être introduits afin d'arriver à un résultat satisfaisant à tous les points de vue.

Depuis de longues années, il existe en Belguique une réglementation de la désinfection des voitures. Les instructions prescrivent que les voitures "souillées" soient détachés du train et désinfectées à la station la plus rapprochée ou en cours de route. Quant aux voitures ayant servi à transporter des cholériques, des pestiférés, etc., ou des voyageurs notoirement signalés comme atteints de maladies transmissibles, elles sont expédiées, portières fermées à clef et plombées, à l'atelier central des voitures à Malines, oú elles sont soumises à une formalisation intense au moyen de l'appareil Hoton.

Ces prescriptions, parfaites en elles-mêmes, me paraissent insuffisantes, en admettant même que l'exécution en soit rigoureuse. Leur application limitée à quelques voitures déterminées, n'atteint pas le but que je veux poursuivre. À côté des voyageurs atteints de maladies signalées, pestilentielles, internationales, oserais-je dire, les wagons transportent chaque jour, et à toute heure du jour, des milliers de voyageurs porteurs, à leur insu, de germes de maladies transmissibles. Je vise ici plus particulièrement la tuberculose, la scarlatine, etc. De plus, la Belgique sert de voie de passage à des milliers d'émigrants qui viennent d'Allemagne, de Russie, de Suisse, d'Italie, etc., et qui vont s'embarquer à Anvers.

Ces milliers de voitures devraient être systématiquement et periodiquement soumises à un nettoyage approfondi et à une désinfection efficace. En un mot, la désinfection devrait être généralisée. Mais le procédé avec l'appareil Hoton est lent et coûteux.

L'Inspeteur Général du Service de Santé de l'Armée qui est, en même temps, Inspecteur Général du Service Médical des Chemins de Fer de l'État, fut chargé de rechercher pour la désinfection des locaux, et en vue de prévenir la propagation d'affections contagieuses quelconques, un procédé et un appareil simple, d'un maniement facile, sans aucun danger, pouvant fonctionner à peu de frais, avec un personnel restreint, tout en offrant une efficacité reconnue.

Avant d'ordonner ces recherches, l'inspecteur général écarta systématiquement, et avec raison, les procédés basés sur l'emploi du su-

blimé corrosif, de l'acide phénique, de la chaux, du permanganate de potasse et des divers produits à base de phénols ou de crésols. Ces moyens, en effet, laissaient à désirer soit au point de vue de l'efficacité soit au point de vue de l'altération, de la détérioration des objets soumis à l'action de la substance bactéricide. L'inspecteur général s'en tint donc exclusivement à la méthode de désinfection par la formaline et fit procéder dans les laboratoires de bactériologie de l'armée à des expérimentations en vue d'apprécier la valeur comparative des divers procédés déjà utilisés ou nouveaux: procédé par l'appareil Hoton, procédé par l'Autane et procédé par le mélange Carteret.

Nous connaissons le procédé Hoton. Il a une efficacité incontestable. Les bactéries les plus résistantes, à formes végétatives ou sporulaires, le staphylocoque doré, les bacilles de la fièvre typhoïde, de la diphtérie; les streptocoques ont été rendus stériles après une désinfection prolongée pendant sept heures. Mais, comme je l'ai dit, il ne répond pas aux desiderata exprimés par l'administration des chemins de fer qui avait le plus grand intérêt à utiliser des appareils dont le maniement est simple, peu coûteux et n'exige qu'un personnel restreint.

Le produit nommé Autane est un mélange de bioxyde alcalino-terreux (peroxyde de baryum) et de trioxyméthylène. Les expériences de M. le Professeur allemand Flügge ont prouvé que tout procédé de désinfection où la formaline est pulvérisée sans l'intervention de la vapeur d'eau est irrationnelle et inefficace. En présence de l'eau, de préference tiède, l'Autane donne naissance à des vapeurs de formol et à de la vapeur d'eau. L'hydroxyde alcalin dépolymérise le trioxyméthylène qui redevient de la formaldéhyde. Cette réaction chimique s'opère avec grande production de chaleur, favorisant ainsi la diffusion rapide des vapeurs d'eau et de formaline. La technique du procédé est simple. Dans un récipient étanche contenant une quantité de poudre d'Autane proportionnée au cube de la chambre, on verse de l'eau tiède en quantité déterminée par un trait tracé à l'intérieur de la boîte. On remue le mélange à l'aide d'une baguette de bois. Le dégagement de vapeurs se produit au bout de quelques instants. La durée de la désinfection a été de sept heurs. Le procédé est encore coûteux puisque la désinfection revient à 17 centimes environ le mètre cube d'air stérilisé.

Le procédé " aldogène " des chimistes français (MM. Carteret) est basé sur l'action de l'hypochlorite de chaux sur le trioxyméthylène, polymère solide de l'aldéhyde formique. Le mélange intime de ces corps en présence de l'eau, le brassage dans une ample cuvette résistant à la chaleur et aux réactifs et mauvaise conductrice de la chaleur, produisent au bout de 15 à 30 secondes une vive réaction qui s'opère avec échauffement du mélange jusqu'à 108° C. et donne lieu à

un dégagement brusque et abondant d'aldéhyde formique et de vapeur d'eau. Le rendement en aldéhyde correspond à environ 70 pour cent du trioxyméthylène employé. Pour un local de 20 à 25 mètres cubes, les quantités de substances employées furent les suivantes; Hypochlorite calcique, 145 grammes, trioxyméthylène, 72 grammes, et eau, 172 grammes. La durée de désinfection nécessaire fut de sept heures. (Communication au Congrès pour l'Avancement des Sciences qui se tint en 1908, à Clermont-Ferrand, et Compte-rendu de l'Académie des Sciences, pp. 146–819.)

Les microbes d'épreuves furent les mêmes dans les diverses expériences. Dans un local de 20 à 25 mètres cubes, hermétiquement fermé, les cultures renfermées dans des boîtes de Pétri entr'ouvertes furent disposées à des hauteurs différentes. On suspendit également dans le local de petits tubes en verre contenant des bandelettes de papier à filtrer impregnées de cultures de staphylocoques. Ces tubes ouverts aux deux extrémités, mais bouchés par de légers tampons d'ouate, pouvaient facilement être transportée au laboratoire sans crainte de souillure. Les cultures des boîtes de Pétri et des tubes restèrent stériles. En ce qui concerne le bacille de Koch, la stérilisation se fit dans les mêmes conditions que pour les autres bactéries, mais le contrôle nécessita une méthode spéciale. On inocula à des cobayes, par voie intrapéritonéale, les produits tuberculeux soit humides, soit desséchés, et préalablement émulsionnés dans du bouillon stérilisé, qui avaient été retirés du local désinfecté. Ces animaux furent tenus en observation pendant trois semaines. Ils ne perdirent pas en poids. Ensuite ils furent sacrifiés et autopsiés. Ils furent trouvés indemnes de toute infection tuberculeuse.

Deux remarques furent faites au sujet de ce procédé. Pour des locaux plus vastes l'action stérilisante exigerait non pas 7 mais 10 à 12 heures. D'autre part, on objecta que le dégagement de chlore résultant de la réaction pouvait avoir une action sur les métaux exposés aux vapeurs stérilisantes. M. le chimiste Vervaeke, pharmacien principal à l'Hôpital Militaire de Bruxelles, put établir que les quantités de chlore dégagé se chiffrent par 0 gramme 0.0768 pour 20 mètres cubes, ou 20,000 litres d'air, quantité insignifiante dont il n'y a pas lieu de tenir compte, car le chlore disparaît bien vite dans le milieu réducteur où il se dégage. D'ailleurs, des instruments de chirurgie nickelés ou enacier poli, un plateau de balance en cuivre ont été suspendus dans le local à désinfecter et n'ont présenté ni corrosion ni détérioration. Le fer, par sa nature facilement oxydable, est legèrement attaqué. Le cuivre subit un certain ternissement qu'on fait vite disparaître avec un peu de poudre à nettoyer les métaux.

Ces diverses recherches bactériologiques, dont je ne transcris pas ici les résultats détaillés afin d'éviter des longueurs, furent faites par MM. Dineur, Dupont et Defalle, médecins militaires, chefs des labo-

ratoires des hôpitaux d'Anvers, de Bruxelles et de Liège. Elles permirent d'arriver aux conclusions suivantes:

Le procédé Horton est parfait, mais il exige un matériel coûteux, un personnel expérimenté. Il est d'un maniement difficile et n'est pas sans danger. Son prix de revient est élevé.

L'Autane ne nécessite l'emploi d'aucun appareil spécial. La méthode est simple, commode. Le prix de revient est moins élevé que celui du procédé Hoton, maisil est encore de 17 centimes environ par mètre cube.

La méthode par le mélange Carteret est d'une efficacité parfaite, surtout pour les petits locaux. Le procédé est très simple; il peut être utilisé sans aucun danger et par un personnel des plus restreint. Le prix de revient n'est que de 2 à 3 centimes par mètre cube.

Ces conclusions firent l'objet d'un rapport que M. le Docteur Froumy, l'inspecteur général actuel, fit adopter par la Commission Consultative Médicale des Chemins de Fer et par le ministre ensuite. Un ordre spécial de service du 3 novembre 1911, prescrivit l'emploi du procédé Carteret pour la désinfection des locaux.

Ce procédé Carteret pourrait donc avantageusement remplacer le procédé par l'appareil Hoton pour la désinfection des wagons à voyageurs.

Mais la stérilisation périodique, systématique, de toutes les voitures, au moyen du procédé Carteret ou Hoton ou tout autre basé sur les mêmes principes, ne saurait entrer dans la pratique, quelle que soit l'économie du procédé en lui-même.

En effet, il ne faut pas perdre de vue que chaque désinfection exige, pour le nettoyage, pour le démontage et le brossage des capitonnages et pour la fermeture hermétique des voitures, une manipulation longue et soigneuse, une main-d'œuvre considérable, et de plus l'immobilisation du véhicule pendant un temps assez long. D'où la nécessité d'augmenter le matériel roulant. Il y a là une source de dépenses sérieuses dont il faut tenir compte si on veut étudier en entier la mise en pratique de la "désinfection généralisée."

Le système de l'enlèvement des poussières par le vide, grâce aux appareils "vacuum cleaner," a simplifié la chose dans une certaine mesure.

Je dois rappeler ici un côté de la question qui offre une importance capitale. Je veux parler du danger de contamination auquel sont exposés les nombreux ouvriers appelés à exécuter les diverses manipulations que je viens d'énumérer.

D'autres appareils à désinfection, entr'autres les pulvérisateurs portatifs de la firme Geneste, Hercher & Co., ont été utilisés par certaines compagnies de chemins de fer pour la désinfection de leurs wagons à voyageurs. Je mets en doute l'efficacité absolue de la solution de formol projetée dans ces conditions.

Il y a donc à trouver mieux, et c'est dans ce but que j'appelle l'attention sur un appareil que la maison Julius Pintsch, de Berlin, a fait construire et qu'on a utilisé à l'atelier de Potsdam.

Anciennement un nettoyage à fond n'était possible qu'en enlevant les revêtements en bois et tout ce qui était capitonné. Ce nettoyage exigeait beaucoup de temps et de main-d'œuvre, ce qui fait que les voitures restaient pendant des semaines à l'atelier. D'autre part, il y avait à craindre que la vermine de toutes sortes provenant des voitures nettoyées ne reste dans l'atelier et aille souiller d'autres voitures. De plus, les germes de maladies contagieuses pouvaient infecter le personnel ouvrier. Enfin, les planchers des wagons-restaurants et de leur cuisine sont souvent mouillés, ce qui est une source de décompositions multiples. L'appareil Julius Pintsch permet d'éviter les conséquences désastreuses et onéreuses que je viens d'énumérer. La voiture est nettoyée en bloc; la vermine est tuée dans une atmosphère portée à 40° à 50° C. et raréfiée jusqu'à 70 à 74 centimètres sous la normale de la colonne de mercure. L'emploi de la formaline assure une désinfection totale et profonde. Là où la chaleur seule ou le vacuum seul restaient inefficaces, l'action des deux moyens véunis assure la destruction complète sans abîmer le laquage et le vernis et sans démonter le capitonnage.

L'appareil a une forme cylindrique de 5 mètres de diamétre et de 25 mètres de longueur. Il se compose de 15 anneaux de fonte soutenant 14 pièces composées de plaques de fonte. Les deux bouts du cylindre sont fermés par des plaques de fonte. Ces diverses armatures métalliques sont si fortement construites qu'il ne se produit pas de déformation par le poids même, ni par le chargement d'une voiture de 60 tonnes ni par la pression de l'air extérieur quand le vacuum a fontionné. Des anneaux de caoutchouc placés aux deux plaques de fond assurent une obturation hermétique.

A l'intérieur du cylindre sont placés deux rails avec butoirs. Sur ces rails vient se placer la voiture à désinfecter qui y est amené de l'extérieur, grâce à des trorçons de rails qui assurent la continuité de la voie.

Le couvercle de devant est amené devant le cylindre qu'il doit fermer, grâce à l'action d'une grue reposant sur le milieu du cylindre d'une part, sur deux petites roues roulant sur un cercle-rail d'autre part. Un seul homme suffit pour manœuvrer la pièce.

Une chaudière placée contre le cylindre permet de projeter la vapeur dans ce dernier, grâce à un tuyau principal auquel viennent aboutir une foule de petits tuyaux. Le cylindre ainsi chauffé offre une température de 50 à 60° C. Des ventilateurs placés dans le cylindre et tournant en sens inverse assurent le brassage de l'air chauffé. L'eau de condensation tombe automatiquement au fond de l'appareil.

Egalement au fond du cylindre se trouve le vaporisateur de formaline, réservoir à double fond. Entre les deux on fait arriver la vapeur qui vaporise la formaline placée sur le fond supérieur.

Des thermomètres, qu'on peut contrôler par des judas, sont placés à l'intérieur du cylindre qui est éclairé à l'électricité.

Des planches sont aménagées le long des deux côtés, permettant la circulation à l'intérieur du cylindre.

La capacité de l'appareil est d'environ 500 mètres cubes. La raréfaction de l'air s'obtient grâce à une pompe actionnée par un moteur placé à côté de la chaudière. L'air aspiré est refoulé dans un tuyau qui débouche sous la chaudière à vapeur ou qui peut être dirigé directement dans le feu qui brûle ainsi les germes et les anéantit sans danger.

On peut chauffer l'appareil à 100° C. par une température extérieure de 15° C. Une chaleur de 50° C. s'obtient en une heure. La voiture à désinfecter n'est complètement chauffée qu'après cinq heures.

La raréfaction de l'air s'obtient en deux heures. Les parties polies de la voiture, les parties laquées, ne présentent pas de détériorations.

La désinfection à la formaline s'opère rapidement, mais sa durée n'est pas bien déterminée. Il faut de nouvelles expériences.

La construction complète de l'appareil Julius Pintsch revient à 100,000 francs environ.

Le coût de la désinfection d'un grand wagon-restaurant est de 20 marks environ, de 23 à 35 marks si on compte l'amortissement et l'intérêt du capital à 5 pour cent.

Les détails techniques de la construction de l'appareil ne sont pas du domaine médical. C'est pourquoi je les passe sous silence.

Au premier abord ces chiffres pourraient faire réfléchir. Mais qu'on se souvienne du prix de la désinfection par les procédés anciens les plus économiques; qu'on y ajoute le prix de la multiple main-d'œuvre utilisée; qu'on calcule la perte résultant de la longue immobilisation du matériel roulant; qu'on tienne compte de l'usure rapide de ce matériel constamment démonté et remonté, et je suis persuadé que la préférence ira à l'appareil de M. Julius Pintsch.

D'ailleurs, tous les procédés anciens, quels qu'ils soient, ne garantissent pas une efficacité reconnue et de plus exposent à la contagion les nombreux ouvriers employés à leur maniement. L'appareil Julius Pintsch échappe à ce reproche.

Les conclusions figurant au Bulletin du Congrès des Chemins de Fer, de février 1904, page 83, tendaient déjà vers ce but que la maison Julius Pintsch vient de réaliser, c'est-à-dire, la désinfection en bloc d'une grande voiture à voyageurs à couloir.

Il serait à souhaiter que toutes les compagnies de chemins de fer installassent en différents points de leur réseau et en nombre suffisant un appareil à désinfection du genre de celui dont je viens de faire la description sommaire.

SANITATION OF RAILWAY CAMPS.

T. D. Tuttle, M. D., Executive Officer, Montana State Board of Health, Helena.

The insanitary conditions existing in railroad construction camps and railroad repair camps bear a closer relation to public health than is apparent from the surface indications, if I may borrow a mining expression.

These camps are located immediately on the right of way of our public carriers, and it is very easy to appreciate how communicable diseases existing in these camps may be transmitted from the camps to the railway passengers. The careless disposal of excreta at such camps furnishes abundant infection for the fly to carry into the dining car, sleeper, and day coach. But not only is it through the fly that infection from these camps reaches the people.

The camps are almost invariably, always when possible, located upon the banks of a stream, and, without regard to the number of people who depend on this stream for their domestic water supply, the inmates of a camp convert the stream into a sewer. With these two points alone we have sufficient ground to require thorough sanitary supervision of railway-construction camps, railway-repair camps, and all domestic camps.

In the study of the railway camp in general we are confronted with the problem arising from the character of the people that are found in them. They are a class of people who are naturally uncleanly, uncleanly with regard to their persons, uncleanly in their habits, and to attempt to teach them the importance of cleanly habits would require the work of more than one generation. We must therefore look to the manager or the head contractor to see that the camps are kept clean and in a sanitary condition, and must hold him responsible for the condition in which each portion of the camp is found on inspection.

DISPOSAL OF HUMAN EXCRETA IN CAMPS.

Follow any railway line that is doing extensive construction work, and note the increase in typhoid fever in the communities through which the construction gangs pass. In Montana we have recently gone through a siege of typhoid fever following, or springing up around, railway-construction camps. This disease does not stop at the camps, but is carried by flies and by water from the camp into the surrounding country. To say that flies bore typhoid fever from a construction camp located over 50 miles from one of our towns would seem preposterous, and yet it appears that this was the way the disease was carried. The farmers in the locality immediately adjoining the camp carried their produce to the camp to sell, became infected either at the camp, or with material that they had carried

home from the camp (often we find farmers carrying swill from the camp to their farms), and from one farm the disease extended to another, until we could trace a line of cases of typhoid fever reaching from this railway camp into the city of Lewistown, and resulting in an epidemic in the town, caused primarily from infection in the railway camp located 50 miles away.

In another instance an epidemic of typhoid fever in a small town promptly followed the locating of a construction camp on the bank of a creek some distance above the town. There was no public water supply in the town, but a great many of the people depended on this stream for their domestic water supply, and the infection of the town came from the disposal of human excreta in the stream at the camp located above the town.

Go to the contractor of one of these construction camps and call his attention to the importance of having properly constructed toilets, and he will promptly inform you that the men will not use these toilets, but that they answer nature's call wherever they happen to be. But we must reply that it is up to the contractor to see that his men use these toilets, and that they do not commit nuisances and infect others with a disease of which they are carriers. That the contractor is often badly mistaken with regard to his men I will show presently by two or three illustrations. We have found that where even the lowest class of men are treated as men they appreciate this treatment and respond more or less promptly.

CAMP KITCHENS AND DINING TENTS.

One of the greatest sources of infection in construction camps is the typhoid carrier. We get more typhoid fever than any other disease from these camps. A man applies for work in a camp, and no question is raised with regard to his previous history or health. He may recently have been released from a hospital where he was treated for typhoid fever. He goes to work in this camp, and in a short time the contractor finds that he has practically an epidemic of typhoid fever to deal with. Ninety-nine out of one hundred of these contractors will not consider for a moment that this outbreak of disease was due to the insanitary condition in his camp. He simply damns his luck and exposes more and more men to infection. How did this one typhoid carrier manage to infect so many men in the camp? Simply through the dining room and kitchen or the water supply. The contractor provided no toilet, and the flies swarmed from the convenient places used by the men into the dining room, until all of the men susceptible to typhoid fever had been infected through the medium of the fly and through one typhoid carrier admitted to the camp.

It is important that the mess room and the kitchen of a camp be screened against flies, just as our dining cars and our hotels are provided with these screens. If we permit contractors to infect the employees, the employees will ultimately infect us. We can not make "fish of one and fowl of another" in public-health work.

WATER SUPPLIES IN CAMPS.

As I have stated, the contractor locates his camp, when possible, immediately upon the bank of a stream; and it may be considered as an overdrawn statement, but everyone who has studied railway-construction camps in this country knows it to be a fact, that we frequently find the favorite toilet ground located on the bank of the stream above the source from which the cook takes his water for domestic purposes, and that the infection does not stop with the immediate camp involved, but follows the stream into the water supply of our cities and towns, and we wonder where our water, that heretofore has been free from infection, became polluted. No camp should be permitted within 100 feet of any stream, no matter how isolated that stream may appear to be.

In 1905 there was a large camp located on the bank of the Missouri River, near Helena. Men in this camp were employed in constructing a dam across the river. Little sickness had prevailed among men in the camp until typhoid fever suddenly broke out and resulted in a large number of cases of this disease. The source of the disease was strenuously sought for. The water supply was a small spring and had been used for a long time before the typhoid broke out. It was at first thought that this fact eliminated the water as a source of the outbreak, but careful investigation revealed the presence of a typhoid carrier in the camp and showed that this carrier had selected as his special location for answering nature's call, a point from which the drainage entered directly into this spring. This fact becoming known and conditions remedied, the typhoid immediately stopped. So far as infection among the men of a camp is concerned, I am personally of the opinion that a typhoid carrier is more dangerous than a case of typhoid fever itself.

SANITATION OF THE HORSE CAMP.

In every railway camp we find a large number of horses employed. A contractor may be fairly clean about other portions of his camp and yet neglect the disposal of refuse from his barn or corral. The disposal of the barnyard refuse is as important as the disposal of human excreta. No camp will be kept in a clean and sanitary condition unless all refuse therefrom is burned, and the burning of the refuse from the barn is fully as important as the burning of any other refuse.

RAILROAD REPAIR CAMPS.

As you travel across this great country you will note on many of the sidetracks box cars with one or two windows cut in them. These are the living quarters of the men who are repairing the railroad bed over which you travel. Get off at some small station and examine the conditions surrounding this so-called camp. There is absolutely no provision made for the disposal of human excreta, and the slops from the cook car and from the dining car—or eating car is a better name for this box—are thrown helterskelter over the ground. Flies swarm around them and carry infection from typhoid carriers or other sources into the dining car and sleeper in which you ride with your family and friends.

We talk a great deal about requiring railroad companies to provide sanitary toilets in their cars which will prevent the excreta falling along the track, and yet there are thousands of men scattered along the lines of every railroad who are furnishing infectious excreta, which is dried into dust by the passing train, and which you and your friends inhale. This railroad camp sanitation is of interest to you, as well as to the men employed in the camp.

WHAT BENEFIT DOES THE CONTRACTOR PERSONALLY RECEIVE UNDER ENFORCED SANITARY REGULATIONS IN HIS CAMP?

In the first place the contractor who runs a strictly clean and sanitary camp will have more men apply to him for positions, and he will thus be enabled to select his men instead of being forced to accept the services of any tramp that chances along. Not only will he be enabled to select his men, but the men that he employs will stay with him. They will be contented. This is true of the small camp as well as of the large.

In 1906 I had occasion to visit a small railway-construction camp. There were only about 80 men employed at this camp. It had been reported that smallpox had broken out in a camp some distance above, and I was following the course of the road and warning the various subcontractors to require all new employees to be disinfected and vaccinated before receiving them into their camps. At this small camp I found that no man was allowed to bring any bedding into the camp. Though the contractor had not heard of smallpox in the neighboring camp, he had required every man going to work for him to remove his clothing, take a bath in the river, and put on a new suit of overalls, until the clothing he was wearing when he came to the camp could be thoroughly disinfected. I asked him why he required the men to go through this cleaning process; why he disinfected their clothes. His reply was: "I don't want dirty men in my

camp, and I don't want lice in my camp; therefore I make the men bathe in the river and disinfect their clothes to kill the lice." This man told me he did not have a single man leave him during the summer, and when I visited his tents I could readily understand why his men stayed with him. His sleeping tent was a 6-foot wall tent with a board floor, was completely screened with mosquito netting, and every man was provided with a spring cot and clean bedding. He said that some of his men were very dirty when they first came to his camp, but that when they saw the clean beds they were very much inclined to sneak quietly down to the river and take a plunge before they would get into them. His cook tent and dining tent were constructed in the same manner and conducted along the same sanitary lines as the sleeping tent. He completed his contract in November, 1906, and told me that the only time a physician ever visited his camp during the nine months he was working on that grade, was when a horse fell and broke the arm of one of his employees. He made money on his contract.

His immediate neighbor, with a contract almost identical, price and everything being practically the same, lost money, because he could not get decent men to work for him. His camp was dirty and insanitary. So much for a small camp.

During 1907 and 1908 an extensive contract was held by a friend of mine in Montana. He was not running a clean camp. He was having considerable sickness and considerable trouble with his men. His contract physician made a fuss about the insanitary condition of the camp and the large amount of unnecessary work being imposed upon him. The contractor did not take very kindly to the words of the physician, but the physician stuck to his point, and, to make a long story short, the camp was placed in a clean and sanitary condition and the sickness stopped. This friend tells me that nothing could induce him to conduct a camp to-day in any other way than that laid down by his contract physician during 1907 and 1908. He tells me that the physician made a great deal more money for him than he did for himself.

During the building of the Chicago, Milwaukee & Puget Sound Railway along the watershed of the river supplying water to the city of Seattle the camps were all under the direct supervision of the Washington State Board of Health. I visited these camps with Dr. Hegg, and they were at all times kept under the most rigid sanitary regulations. Every particle of excreta, both animal and human, was burned in a small incinerator that could not have cost the contractor to exceed $50 at the very outside. Dr. Hegg told me that the contractors objected strenuously at first, but when they saw the influence of these clean camps on their men they told him in substance what my Montana friend told me, that they would never

again conduct a camp under anything except strictly sanitary conditions.

Thus, if we impose strict sanitary regulations on railroad camps, railroad-repair camps, and every other camp, we are not working a hardship on the contractor, but rather doing him a personal favor, although he will refuse to admit it at first, and some will never admit the benefit derived from cleanly conditions, but we know the benefits do accrue. A study of the laws and regulations relative to camps, so far as I have been able to secure them, shows very little effort to control these conditions. Very few States even mention camps of any kind in their sanitary codes, and but few boards of health with authority to make regulations have embraced the camps in the regulations promulgated by them. At a meeting of representatives of five States, namely, Minnesota, Idaho, North Dakota, Washington, and Montana, held in March, 1912, the following camp regulations were tentatively adopted, it being the intent that each State having the power to do so would make these a part of their regulations, while those States without power to make and enforce regulations would try to secure legislation embracing these ideas:

REGULATIONS ON CAMP SANITATION.

REGULATION 18. That hereafter contractors and all other persons who may establish an industrial camp or camps for the purpose of logging or any like industry or for the purpose of constructing any road, railroad, or irrigation canal or other work requiring the maintenance of camps for men engaged in such work, or any other temporary or permanent industrial camps of whatsoever nature, shall report to the State commissioner of health concerning the location of such camp or camps, and shall arrange such camp or camps in a manner approved by the State board of health so as to maintain good sanitary conditions, and shall at all times keep such camp or camps in a sanitary condition satisfactory to the State board of health.

REGULATION 19. Camps should be established upon dry, well-drained ground.

REGULATION 20. Any natural sink holes or collections of pools of water should be artificially drained and filled when the camp is first established.

REGULATION 21. The general scheme of the relation of the structure of the camps should be as follows: Stable and kitchen should be at the opposite ends of the camp and separated by a distance as great as is consistent with the natural topography of the land and with the necessity for convenient access to the stables.

REGULATION 22. Eating houses should be next to the kitchen, and beyond the eating house should come the bunk houses, and between the bunk houses and the stables the toilets for the men in the camp.

REGULATION 23. The use of the toilets provided for the men should be made obligatory, and instant discharge of any employees polluting the soil must be rigidly enforced to make such rules effective.

REGULATION 24. Coal-oil cans filled with sawdust, empties and freshly limed each day, provide convenient and acceptable urinals for the bunk houses.

REGULATION 25. A small temporary incinerator should be constructed near the stables. Incinerators capable of doing effective work can be constructed

for not over $25 sufficient to care for all the refuse of a camp of 150 men and stables of 10 to 12 horses.

Regulation 26. There must be, in camps of 100 men or over, one employee whose particular duty should be acting as scavenger and garbage collector.

Regulation 27. All manure should be gathered and burned each day and, for the convenience of the collector, should be thrown into a tightly covered box.

Regulation 28. All fecal matter should be treated in the same way or else treated in some other approved manner. Collection and incineration is the safest in the long run and the easiest method, by making use of the removable pan, which can be freshly limed.

Regulation 29. The kitchen and eating house in particular should be effectively screened. It is also desirable to have this done for the bunk houses.

Regulation 30. All garbage should be collected in tight cans and incinerated daily along with the manure and other rubbish.

Regulation 31. Noninflammable refuse, such as tin cans, should be collected daily and placed in a deep earth pit and covered with a light covering of earth each day.

Regulation 32. All urinals should consist of open trenches lined with quicklime, and fresh quicklime should be added in the proportion of one-half barrel per day per 100 men.

Regulation 33. All food supplies should be carefully screened.

Regulation 34. Thorough and systematic scrubbing of kitchens and eating houses and, to a less extent, bunk houses should be regularly insisted upon.

Regulation 35. The supply of water for the camp should be carefully decided upon and, wherever possible, if the camp is to remain several weeks, it is well to run it in pipes from an absolutely uncontaminated source.

Regulation 36. All persons sick, from whatever cause, should be isolated from the remainder of the crew immediately.

Regulation 37. All persons engaged in the care of the premises and handling of the food—particularly cooks and helpers—should be carefully examined and particular attention paid to the point as to whether or not they have suffered from typhoid fever within recent years.

These regulations were thoroughly gone over by the State Board of Health of Montana, and, at a meeting held on July 15, 1912, they were adopted and made a part of the rules and regulations of the State Board of Health of Montana, which have the force and effect of law in our State. These regulations are to go into effect in Montana on the 1st day of October, 1912, and we hope thereafter to secure a radical change in the sanitation of the camps in our State, and we can not too strongly urge upon you, as sanitarians, the importance of looking after camps as one of the fruitful sources of infection, not only for the laboring man, but for the man who rides in the palace car and lives in the high street dwelling.

A FURTHER STUDY OF THE VENTILATION OF SLEEPING CARS.

THOMAS R. CROWDER, M. D., Chicago, Ill.

Two years ago I presented before the American Public-Health Association the results of a study of the ventilation of sleeping cars.[1] An attempt was made to determine the amount of fresh air which enters the running car under various conditions of operation, the places of entrance of the air, its distribution, and the general direction of its currents. Two plans of ventilating were considered in that study, which were called "natural ventilation" and "ventilation by exhaustion."

The essential architectural features of the standard American railway car are, as they concern the question under discussion, that it contains one long room with end doors, opening to vestibules, and side windows, and was originally intended to receive its air supply through a row of small windows set in near the roof line on either side and called deck sashes. Part of the cars investigated in the study referred to were ventilated in this way, as are still the vast majority of the railway cars in this country. Since natural forces alone are depended upon to induce air interchange this plan was referred to as "natural ventilation."

To the majority of the cars investigated there had been applied a device[2] intended to remove air through certain of these upper windows, or deck sashes, by a suction effect dependent upon train motion, all other deck sashes remaining closed. This plan was called "ventilation by exhaustion." It would tend to reverse the fresh-air currents from a downward to an upward direction; instead of air being admitted at the top by natural forces through openings provided for that purpose and allowed to find its own way out, it is removed at the top by artificial devices and left to find its own way in. That the exhaust apparatus actually does what it was intended to do was easily determined by means of the anemometer. It was found that each of these exhaust ventilators would remove about 15,000 cubic feet of air per hour at a 40-mile train speed. Six to eight of them were applied to each car. The problem then was to determine the manner of entrance of the air, the general course of its currents, and the efficiency of the device in maintaining a fresh-air supply to the breathing zone for the passengers and to the occupied berth, and to compare the results obtained by the two methods of ventilation. This was done by determining the respiratory contamination as represented by the proportion of carbon dioxide in the air. It is well known that from such determinations air supplies can be computed[3] with considerable accuracy.

About 2,000 samples of air were analyzed and the results showed that by the application of this exhaust device the active ventilation of the body and berths of a sleeping car is considerably increased

over and above what may be expected from the natural forces of the wind through the open deck-sashes, and that the flow of fresh air into the car is more regular and better distributed. The many crevices about doors and windows act as intakes, and the trend of the currents is of course upward. The respiratory contamination of the air of the breathing zone and of the occupied berth remains almost constantly low. Carbon dioxide reaches a proportion of 10 parts in 10,000 of air with relative rarity; and the computed fresh-air supply averages about 2,000 cubic feet per hour for each berth and about 40,000 cubic feet per hour for the car.

With the adoption of this exhaust system of ventilation as a standard of construction the deck-sashes cease to perform any important function. Indeed, they may become a direct hindrance to the most efficient operation of the device. They are of necessity, from their location and the method of their operation, loose-fitting windows which furnish large crevices for air leakage. Since these crevices are located very near the outlets of the exhaust ventilators the air entering through them is liable to be drawn directly out again and to play no part in effecting renewal of the air of the breathing zone. Furthermore, it tends to prevent air being drawn upward from the window crevices located below and the effective renewal of the air of the lower levels. That such short-circuiting does take place was shown in the study referred to; whereas, by actual measure, some 80,000 cubic feet of air leaves the car each hour through the exhaust ventilator openings, there is only about 40,000, as computed from CO_2 determinations, supplied to the breathing zone. The difference between the aeration of the breathing zone and the total air supply is not so great, however, as these figures would seem to indicate, since it is well known that CO_2 determinations generally give an air supply which is under rather than over the actual; and the figures include in this instance slow speeds and short stops, whereas the measured amount is for a 40-mile speed.

The study from which the foregoing is drawn was made on the standard Pullman sleeping car of wooden construction. The exhaust ventilator considered was applied to cars which had been previously in service and had been originally ventilated by the natural or deck-sash method. Since the completion of that study the all-steel sleeping car has come into extensive use. These cars are all equipped with exhaust ventilators in the building; and for the reasons stated in the last paragraph the deck sashes are omitted, or, if not entirely omitted, they are reduced from 24 to 4, and these 4 are very small. Only electricity is used for lighting; this avoids the necessity of making openings through the roof to carry away the combustion gases of burning lights. The upper portion of the car is seen to be almost entirely free from natural openings. It therefore follows that whatever

air enters must come from crevices about windows and doors located low down, and it is a natural inference that because of this the lower levels of the car would receive a larger air supply. It was not considered a matter of great hygienic importance whether they do or do not. No increase in the air supply was demanded on hygienic grounds; but in order to have some adequate information as to what actually does take place and to be able to make accurate comparisons with the older type of construction, a series of 36 steel cars were investigated during the first two months of this year.

The methods used in the investigation of these cars are the same as those previously employed. They are fully outlined in the original paper,[1] to which those interested are referred. Samples of the air to be examined were collected in glass-stoppered bottles, sealed, and were analyzed in the Petterson-Palmquist apparatus for the determination of carbon dioxide. Air was collected from the center aisle, in order to determine the respiratory contamination of the general air of the car and from occupied lower and upper berths in order to determine the respiratory contamination of the air within them. From these contaminations air supplies have been computed as has been previously explained.[3]

All the observations in the cars included in the present series were made during the night, after the passengers had retired. The time ranged from 11 p. m. to early morning. The outside temperature varied from 0° F. to 36° F.; it was generally as low as 20° F. Samples were taken as near simultaneously as possible in the aisle and in from three to six berths. Samples from the same places were repeated at approximately 15-minute intervals for one or two hours. This was done in order to obtain general averages, which are more important than single observations or short series. From the latter, erroneous conclusions are very likely to be drawn. It must be recognized that in any running car the conditions are liable to rapid and relatively great variation. Minimum actual rates of air supply, hence degrees of respiratory contamination, alternate with maximum actual rates; and these minimums and maximums may lie a considerable distance apart. They represent temporary and local, not continuous and general, conditions. Averages are much more significant.

GENERAL RESULTS.

In Table I are assembled the more important items concerning the general air of the cars examined. The air tests recorded in this table refer only to the samples collected from the car body, and not to those collected from the berths. The air supply as computed is expressed to the nearest thousand in terms of cubic feet per car per hour. It is that volume which would keep the CO_2 at the average proportion found in the air of the car if the number of occupants did not change.

TABLE I.—*Determinations of the ventilation of steel sleeping cars equipped with exhaust ventilators.*

Experiment.	Name of car.	Temperature.		Number of people in car.	CO_2 per 10,000.				Approximate hourly air supply.
		Out.	In.		Number of tests.	Average.	Extremes.		
							Minimum.	Maximum.	
		°F.	°F.						
1	Cresheim	12	52	16	6	5.50	4.5	6.0	64,000
2	Millard [a]	36	60	15	8	5.25	4.5	6.5	72,000
3	Brightwood [a]	10	56	15	7	6.00	5.0	7.0	45,000
4	Thurston	30	56	28	7	6.79	6.0	8.5	60,000
5	Sparks [b]	34	60	18	10	5.45	4.5	7.0	74,000
6	Cresheim [a]	20	58	19	11	5.82	5.0	7.5	70,000
7	Parkerton [a]	24	61	10	9	5.28	4.5	6.0	47,000
8	Bridgeport [a]	24	60	10	8	5.56	4.5	6.5	38,000
9	Millard [c]	26	59	14	9	4.77	4.5	5.5	109,000
10	Lemay [c]	26	60	15	9	4.72	4.5	5.0	125,000
11	Amsden	30	60	18	7	6.00	5.0	8.0	54,000
12	Walworth	30	63	17	7	5.71	5.0	8.0	59,000
13	Thurston	24	54	19	7	6.57	6.0	7.0	44,000
14	Moorfield	24	60	18	7	5.93	5.5	6.5	56,000
15	Bogero	20	58	12	7	5.21	4.5	5.5	59,000
16	Somena	20	58	16	7	5.50	5.0	6.0	64,000
17	Wawa	30	62	18	9	6.39	5.5	9.5	45,000
18	Nepperhan	24	63	18	7	5.79	5.0	7.0	60,000
19	Monteith	24	58	16	7	6.36	5.5	7.0	41,000
20	Ship Road	6	60	12	7	5.14	4.5	6.0	63,000
21	Hyndman	6	60	8	7	4.79	4.5	5.5	57,000
22	Thurston [d]	6	58	26	7	7.21	6.0	9.5	49,000
23	Roseton [d]	6	60	22	4	8.13	7.5	8.5	32,000
24	Colfax	16	60	16	6	5.92	5.0	8.0	50,000
25	Dorrance	16	60	17	5	5.40	5.0	5.5	72,000
26	Onchiota	24	60	15	5	5.20	4.5	6.0	75,000
27	Canfield	24	60	21	5	7.10	6.0	8.0	41,000
28	Carrothers	0	58	15	6	5.83	5.0	6.5	49,000
29	Wawa	0	58	14	6	6.66	5.5	8.0	33,000
30	Elkland	8	56	20	5	6.30	5.5	7.5	52,000
31	Onchiota	8	56	15	6	6.25	5.5	7.0	40,000
32	Middletown	8	68	12	3	5.33	5.0	5.5	54,000
33	Josslyn	20	62	15	5	5.30	5.0	5.5	69,000
34	Halleck	20	62	12	6	5.08	4.5	6.0	67,000
35	Millard	12	58	12	7	5.07	5.0	5.5	74,000
36	Henefer	12	60	10	7	4.93	4.5	6.0	65,000
	Total (36 cars)	.....	.....	16.2	246	5.78	4.5	9.5	54,600

[a] Drop sashes of end doors open 3 inches.
[b] Drop sash of rear door open 12 inches.
[c] Drop sashes of end doors open 24 inches.
[d] Train running directly with a strong wind.

See note 4 concerning drop sashes of end doors.

The observations from which Table I is compiled may be summarized as follows:

Cars examined	36
Average number of occupants	16.2
Number of air samples analyzed	246
Average number of samples per car	6.86
Average carbon dioxide	5.78 : 10,000
Highest average CO_2 in any car	8.13 : 10,000
Lowest average CO_2 in any car	4.72 : 10,000
Highest CO_2 in any sample	9.5 : 10,000
Lowest CO_2 in any sample	4.5 : 10,000
Number of samples showing CO_2 over 10 : 10,000	0 (0.00 per cent)
Number of samples showing CO_2 over 8 : 10,000	5 (2.03 per cent)
Number of samples showing CO_2 over 7 : 10,000	20 (8.13 per cent)
Number of samples showing CO_2 over 6 : 10,000	56 (22.72 per cent)
Number of samples showing CO_2 of 6 or less : 10,000	190 (77.22 per cent)

	Cubic feet.
Average hourly air supply per car	54,600
Highest hourly air supply for any car	125,000
Highest excepting Nos. 9 and 10[4]	75,000
Average excepting Nos. 9 and 10[4]	53,000
Lowest hourly air supply for any car	32,000
Number of cars showing less than 40,000 cubic feet per hour	3

The average air supply to the breathing zone of the steel sleeping car, as computed from the average proportion of CO_2 and the average number of occupants in the 36 cars examined, is found to be approximately 54,600 cubic feet per hour, as above stated; or, in those cars kept entirely closed, even to drop sashes in the end doors,[4] 53,000 cubic feet per hour. This compares with 40,600 cubic feet per hour for the older type of car, equipped with the same ventilating device, but maintaining the deck-sash construction, and with 28,300 cubic feet per hour for cars having the ordinary deck-sash ventilation. The results in the steel car are also more uniform and more regular, as will be found by consulting the detailed results of the first group of experiments.[1] The complete comparative averages may be grouped as follows:

A. *Wood cars (with deck-sash construction).*

	Cubic feet per hour.
Natural ventilation (deck-sash method):	
Fully closed car	18,500
With open deck-sashes	28,300
With open deck-sashes and open end doors	40,700
Exhaust ventilation (the exhaust method):	Cubic feet.
Fully closed car	40,600
With open end doors	57,900

B. *Steel cars (constructed without deck-sashes).*

	Cubic feet.
Exhaust ventilation:	
Fully closed car	53,000
With open drop sashes in end doors[4]	65,900

Any or all of these figures might be changed by longer series of observations. For most of the groups it is believed a sufficient number have been made to insure the relative correctness of the results obtained.

THE LOWER BERTH.

In Table II are assembled the observations in lower berths and comparisons with the air of the aisle taken at the same time. It will be noted that the experiments recorded in this table are the same as those presented in Table I and that they cover all the cars investigated. The air supply per berth as computed is the number of cubic feet which must be supplied to one person each hour in order to maintain the CO_2 at the average proportion found. The berths included in this list were each occupied by one adult.

TABLE II.—*Determinations of the ventilation of the lower berths of steel sleeping cars equipped with exhaust ventilators.*

Experiment.	Name of car.	Temperature.		Number of people in car.	Aisles.			Lower berths.							
					Average CO_2 per 10,000 of air.	Extremes.		Number examined.	Number of tests.	Average CO_2 per 10,000 of air.	Extremes.		Tests over 12:10,000.	Tests over 10:10,000.	Approximate hourly air supply per berth.
		Out.	In.			Minimum.	Maximum.				Minimum.	Maximum.			
		°F	°F												
1	Cresheim	12	52	16	5.50	4.5	6.0	4	24	5.73	4.5	7.0	0	0	3,470
2	Millard [a]	36	60	15	5.25	4.5	6.5	4	32	6.64	4.5	10.0	0	0	2,270
3	Brightwood [a]	10	56	15	6.00	5.0	7.0	4	28	6.66	5.0	9.0	0	0	2,250
4	Thurston	30	56	28	6.79	6.0	8.5	3	21	7.12	5.5	10.5	0	1	1,920
5	Sparks [b]	34	60	18	5.45	4.5	7.0	3	30	6.18	4.5	9.5	0	0	2,750
6	Cresheim [a]	20	58	19	5.82	5.0	7.5	4	44	6.69	5.0	9.5	0	0	2,230
7	Parkerton [a]	24	61	10	5.28	4.5	6.0	3	27	6.07	4.5	8.0	0	0	2,900
8	Bridgeport [a]	24	60	10	5.56	4.5	6.5	3	22	7.05	5.0	9.0	0	0	1,970
9	Millard [c]	26	59	14	4.77	4.5	5.5	3	27	6.06	5.0	10.0	0	0	2,910
10	Lemay [c]	26	60	15	4.72	4.5	5.5	2	18	6.06	5.0	7.5	0	0	2,910
11	Amsden	30	60	18	6.00	5.0	8.0	2	14	7.36	5.0	14.0	1	1	1,790
12	Walworth	30	63	17	5.71	5.0	8.0	3	21	7.64	4.5	14.0	1	4	1,650
13	Thurston	24	54	19	6.57	6.0	7.0	3	21	9.02	7.5	10.5	0	1	1,200
14	Moorfield	24	60	18	5.93	5.5	6.5	3	21	6.62	6.0	9.0	0	0	2,290
15	Bogero	20	58	12	5.21	4.5	5.5	4	28	6.41	5.0	8.0	0	0	2,470
16	Somena	20	58	16	5.50	5.0	6.0	2	14	6.64	5.5	8.0	0	0	2,270
17	Wawa	30	62	18	6.39	5.5	9.5	3	27	7.55	5.0	11.5	0	2	1,690
18	Nepperhan	24	63	18	5.79	5.0	7.0	3	21	6.09	5.0	7.5	0	0	2,870
19	Monteith	24	58	16	6.36	5.5	7.0	4	28	7.52	5.5	11.0	0	2	1,700
20	Ship Road	6	60	12	5.14	4.5	6.0	4	28	6.33	4.5	8.5	0	0	2,570
21	Hyndman	6	60	8	4.79	4.5	5.5	4	28	6.36	4.5	11.5	0	1	2,540
22	Thurston [d]	6	58	26	7.21	6.0	9.5	4	28	9.25	7.0	12.5	1	5	1,140
23	Roseton [d]	6	60	22	8.13	7.5	8.5	4	16	9.22	7.5	10.5	0	1	1,150
24	Colfax	16	60	16	5.92	5.0	8.0	4	24	7.01	5.5	10.0	0	0	1,990
25	Dorrana	16	60	17	5.40	5.0	5.5	4	20	5.85	5.5	6.5	0	0	3,240
26	Onchiota	24	60	15	5.20	4.5	6.0	4	20	5.55	4.5	6.5	0	0	3,870
27	Canfield	24	60	21	7.10	6.0	8.0	4	20	7.81	5.0	9.5	0	0	1,570
28	Carrothers	0	58	15	5.83	5.0	6.5	4	24	6.31	5.0	9.0	0	0	2,600
29	Wawa	0	58	14	6.66	5.5	8.0	4	24	6.93	5.0	9.0	0	0	2,050
30	Elkland	8	56	20	6.30	5.5	7.5	4	20	7.01	5.0	9.0	0	0	1,990
31	Onchiota	8	56	15	6.25	5.5	7.0	4	24	6.89	5.5	8.0	0	0	2,080
32	Middletown	8	68	12	5.33	5.0	5.5	4	12	6.50	5.5	7.5	0	0	2,400
33	Josslyn	20	62	15	5.30	5.0	5.5	4	20	5.91	5.0	6.5	0	0	3,140
34	Halleck	20	62	12	5.08	4.5	6.0	4	24	6.85	5.0	10.0	0	0	2,110
35	Millard	12	58	12	5.07	5.0	5.5	4	28	6.21	5.0	7.5	0	0	2,720
36	Henefer	12	60	10	4.93	4.5	6.0	4	28	5.91	5.0	8.5	0	0	3,140
	Total (36 cars)	....	....	16.2	5.78	4.5	9.5	128	856	6.76	4.5	14.0	3	18	2,170

[a] Drop sashes of end doors open 3 inches.
[b] Drop sash of rear door open 12 inches.
[c] Drop sashes of end doors open 24 inches.
[d] Train running directly with a strong wind.

See note 4 concerning drop sashes of end doors.

The observations from which Table II is compiled may be summarized as follows:

Cars in which lower berths were examined	36
Number of lower berths examined	128
Average number of lower berths per car	3.56
Total number of air samples from lower berths	856
Average number of lower-berth samples per car	23.78
Average number of samples per berth	6.53
Average CO_2 in air of car body	5.78 : 10,000
Average CO_2 in air of lower berths	6.76 : 10,000
Highest average CO_2 in lower berths of any car	9.25 : 10,000
Lowest average CO_2 in lower berths of any car	5.55 : 10,000
Highest CO_2 in any lower-berth sample	14.00 : 10,000
Lowest CO_2 in any lower-berth sample	4.50 : 10,000
Number lower-berth samples showing CO_2 over 12 : 10,000	3 (0.35 per cent)
Number lower-berth samples showing CO_2 over 10 : 10,000	18 (2.10 per cent)
Number lower-berth samples showing CO_2 over 8 : 10,000	137 (16.00 per cent)
Number lower-berth samples showing CO_2 over 7 : 10,000	238 (27.80 per cent)
Number lower-berth samples showing CO_2 over 6 : 10,000	476 (55.61 per cent)
Number lower-berth samples showing CO_2 of 6 or less : 10,000	380 (44.39 per cent)
Number of lower berths with higher CO_2 than aisle at same time	658 (76.87 per cent)
Number of lower berths with lower CO_2 than aisle at same time	68 (7.95 per cent)
Number of lower berths with CO_2 equal to aisle at same time	130 (15.19 per cent)

	Cubic feet.
Average hourly air supply per lower berth	2,170
Highest average hourly air supply to lower berths of any car	3,870
Lowest average hourly air supply to lower berths of any car	1,140
Number cars showing average of less than 1,500 cubic feet per lower berth per hour	3

Upon the basis of 856 carbon-dioxide determinations in the air of 126 lower berths in 36 steel sleeping cars equipped with exhaust ventilators, the average air supply per berth is found to be approximately 2,170 cubic feet per hour. This compares with 2,030 cubic feet for the lower berths of the older type of cars equipped with the same ventilating device, and with 1,390 cubic feet in cars ventilated by the deck-sash method.[1]

THE UPPER BERTH.

Table III records the observations made in upper berths and comparisons with the air of the aisle taken at the same time. The items included are the same as those for the lower berths in the preceding table.

TABLE III.—*Determinations of the ventilation of the upper berths of steel sleeping cars equipped with exhaust ventilators.*

Experiment.	Name of car.	Temperature.		Number of people in car.	Aisles.			Upper berths.							Approximate hourly air supply per berth.
		Out.	In.		Average CO_2 per 10,000.	Extremes.		Number examined.	Number of tests.	Average CO_2 per 10,000.	Extremes.		Tests over 12: 10,000.	Tests over 10: 10,000.	
						Minimum.	Maximum.				Minimum.	Maximum.			
		°F.	°F.												
1	Cresheim	12	52	16	5.50	4.5	6.0	1	6	6.08	5.5	6.5	0	0	2,830
2	Millard [a]	36	60	15	5.25	4.5	6.5	1	8	6.50	5.0	10.5	0	1	2,400
3	Brightwood [a]	30	56	15	6.00	5.0	7.0	1	7	6.79	6.0	8.5	0	0	2,150
4	Thurston	30	56	28	6.79	6.0	8.5	1	7	8.36	7.0	11.0	0	1	1,360
5	Sparks [b]	34	60	18	5.45	4.5	7.0	2	20	6.68	5.5	8.5	0	0	2,240
6	Cresheim [a]	20	56	19	5.82	5.0	7.5	1	11	6.82	6.0	8.5	0	0	2,130
10	Lemay [c]	26	60	15	4.72	4.5	5.0	1	9	5.44	4.5	6.0	0	0	4,170
11	Amsden	30	60	18	6.00	5.0	8.0	2	14	6.96	5.5	9.0	0	0	2,030
12	Walworth	30	60	17	5.71	5.0	8.0	1	7	6.29	5.5	8.5	0	0	2,620
13	Thurston	24	54	19	6.57	6.0	7.0	1	7	7.79	6.0	10.0	0	0	1,580
14	Moorfield	24	60	18	5.93	5.5	6.5	1	7	7.43	6.0	8.5	0	0	1,750
16	Somena	20	58	16	5.50	5.0	6.0	2	14	7.07	6.0	9.0	0	0	1,950
17	Wawa	30	62	18	6.39	5.5	9.5	2	18	7.77	6.0	11.5	0	2	1,590
18	Nepperhan	24	62	18	5.79	5.0	7.0	1	7	6.00	5.5	6.5	0	0	3,000
22	Thurston [d]	6	58	26	7.21	6.0	9.5	1	7	7.79	6.5	9.5	0	0	1,580
24	Colfax	16	60	16	5.92	5.0	8.0	2	12	7.42	6.0	9.5	0	0	1,760
26	Onchiota	24	60	15	5.20	4.5	6.0	2	10	5.75	4.5	7.5	0	0	3,430
27	Canfield	24	60	21	7.10	6.0	8.0	2	10	8.70	7.0	10.5	0	1	1,280
30	Elkland	8	56	20	6.30	5.5	7.0	2	10	7.85	7.0	10.0	0	0	1,560
33	Josslyn	20	62	15	5.30	5.0	5.5	2	10	6.45	6.0	8.0	0	0	2,450
34	Halleck	20	62	12	5.08	4.5	6.0	1	6	6.25	5.5	6.5	0	0	2,670
	Total (21 cars)	....	....	17.8	5.86	4.5	9.5	30	207	7.00	4.5	11.5	0	5	2,000

[a] Drop sashes of end doors open 3 inches.
[b] Drop sash of rear door open 12 inches.
[c] Drop sashes of end doors open 24 inches.
[d] Train running directly with a strong wind.

See note 4 concerning drop sashes of end doors.

The results of examination of upper berths may be summarized as follows:

Cars in which upper berths were examined	21
Number of upper berths examined	30
Average number of upper berths per car	1.43
Total number of air samples from upper berths	207
Average number of upper-berth samples per car	9.86
Average number of samples per berth	6.9
Average CO_2 in air of car body	5.86 : 10,000
Average CO_2 in air of upper berths	7.00 : 10,000
Highest average CO_2 in upper berths of any car	8.70 : 10,000
Lowest average CO_2 in upper berths of any car	5.44 : 10,000
Highest CO_2 in any upper-berth sample	11.5 : 10,000
Lowest CO_2 in any upper-berth sample	4.5 : 10,000
Number of upper-berth samples showing CO_2 over 12 : 10,000	0 (0.00 per cent)
Number of upper-berth samples showing CO_2 over 10 : 10,000	5 (2.42 per cent)
Number of upper-berth samples showing CO_2 over 8 : 10,000	34 (16.43 per cent)
Number of upper-berth samples showing CO_2 over 7 : 10,000	83 (40.10 per cent)
Number of upper-berth samples showing CO_2 over 6 : 10,000	139 (67.15 per cent)
Number of upper-berth samples showing CO_2 of 6 or less : 10,000	68 (32.84 per cent)
Number of upper berths with higher CO_2 than aisle at same time	182 (87.92 per cent)

Number of upper berths with lower CO_2 than aisle at same time ..... 13 (6.28 per cent)
Number of upper berths with CO_2 equal to aisle at same time .. 12 (5.80 per cent)

Cubic feet.

Average hourly air supply per upper berth 2,000
Highest average hourly air supply for upper berths of any car 4,170
Lowest average hourly air supply for upper berths of any car 1,280
Number of cars showing average of less than 1,500 cubic feet per upper berth per hour 2

Upon the basis of 207 carbon-dioxide determinations in 30 upper berths of 21 steel sleeping cars equipped with exhaust ventilators the average air supply per berth is found to be approximately 2,000 cubic feet per hour. This compares with 1,880 cubic feet for the upper berths of the older type of cars equipped with the same ventilating device, and with 1,270 cubic feet in cars ventilated by the deck-sash method.[1]

COMPARISON OF LOWER AND UPPER BERTHS IN SAME CAR.

We are able to compare the ventilation of the lower and upper berths in all of the 21 cars in which upper berths were investigated. The comparison for each car is shown in Table IV.

TABLE IV.—*Comparison of the ventilation of lower and upper berths in steel sleeping cars equipped with exhaust ventilators.*

Experiment.	Name of car.	CO_2 per 10,000 of air.					Equivalent hourly air supply per berth.	
		Aisles.	Lowers.		Uppers.			
		Average CO_2.	Number of tests.	Average CO_2.	Number of tests.	Average CO_2.	Lower.	Upper.
1	Cresheim	5.50	24	5.73	6	6.08	3,470	2,880
2	Millard [a]	5.25	32	6.64	8	6.50	2,270	2,400
3	Brightwood [a]	6.00	28	6.66	7	6.79	2,250	2,150
4	Thurston	6.79	21	7.12	7	8.36	1,920	1,360
5	Sparks [b]	5.45	30	6.18	20	6.68	2,750	2,240
6	Cresheim [a]	5.82	44	6.69	11	6.82	2,230	2,130
10	Lemay [c]	4.72	18	6.06	9	5.44	2,910	4,170
11	Amsden	6.00	14	7.36	14	6.96	1,790	2,030
12	Walworth	5.71	21	7.64	7	6.29	1,650	2,620
13	Thurston	6.57	21	9.02	7	7.79	1,200	1,580
14	Moorfield	5.93	21	6.62	7	7.43	2,290	1,750
16	Somena	5.50	14	6.64	14	7.07	2,270	1,950
17	Wawa	6.39	27	7.55	18	7.77	1,690	1,590
18	Nepperhan	5.79	21	6.09	7	6.00	2,870	3,000
22	Thurston [d]	7.21	28	9.25	7	7.79	1,140	1,580
24	Colfax	5.92	24	7.01	12	7.42	1,990	1,760
26	Onchiota	5.20	20	5.55	10	5.75	3,870	3,430
27	Canfield	7.10	20	7.81	10	8.70	1,570	1,280
30	Elkland	6.30	20	7.01	10	7.85	1,990	1,590
33	Josslyn	5.30	20	5.91	10	6.45	3,140	2,450
34	Halleck	5.08	24	6.85	6	6.25	2,110	2,670
	Total (21 cars)	5.86	492	6.93	207	7.00	2,050	2,000

[a] Drop sashes of end doors open 3 inches.
[b] Drop sash of rear door opens 12 inches.
[c] Drop sashes of end doors open 24 inches.
[d] Train running directly with a strong wind.

See note 4 concerning drop sashes of end doors.

It will be seen from this table that the ventilation of lowers and uppers is, on the average, much the same. It is relatively rare for the average air supply of the two to fall far apart. If one is high the other is high; if one is low the other is low. The general averages show results which would indicate that the lower receives slightly more air than the upper, but the difference is almost trifling. In 13 cars the lower received the greater air supply; in 8 cars the upper received the greater supply. This runs counter to the findings of the previous study,[1] where in every car the lowers were found always to receive a little more air than the uppers. In that series there were only 5 cars in which this comparison could be made.

The simultaneous averages of CO_2 in the air of two to four lowers and in one or two uppers in the same car can be compared 148 times. The average proportion of CO_2 in the air of the lowers was less than in the uppers 83 times (56.1 per cent); it was greater 58 times (39.2 per cent); and they were equal 7 times (4.7 per cent).

The proportion of CO_2 in the air of the individual lower and upper berths in the same section, the samples being taken at approximately the same time, can be compared 185 times. The lower berth had less CO_2 than the upper 96 times (51.9 per cent); it had more than the upper 62 times (33.5 per cent); and they were equal 27 times (14.6 per cent). The air supply is, of course, inversely as these proportions of CO_2; the lower had a greater air supply than the upper in 51.9 per cent, a less air supply than the upper in 33.5 per cent, and they were momentarily equal in 14.6 per cent of the cases.

The upper berth has no window opening into it. The edge of the berth is about on a level with the top of the window. There is a space of about one-half inch between the edge of the berth and the wall—a total open space of about 36 square inches. Through this wide crevice the upper berth receives a large part of its air supply, which must then pass inward and upward across the berth and its occupant toward the ventilator exits.

GENERAL COMPARISONS.

We may here bring together the comparative results for the car body and the lower and upper berths in the three classes of cars. The general averages of CO_2 and the computed air supplies are as follows:

A. *Wood cars (with deck-sash construction).*

Natural ventilation (deck-sash method):

Body of car, CO_2=7.32; air supply to car=29,700 cubic feet per hour.
Lower berth, CO_2=8.32; air supply per berth=1,390 cubic feet per hour.
Upper berth, CO_2=8.73; air supply per berth=1,270 cubic feet per hour.

Exhaust ventilation (the exhaust method):

Body of car, CO_2=6.33; air supply to car=40,600 cubic feet per hour.
Lower berth, CO_2=6.96; air supply per berth=2,030 cubic feet per hour.
Upper berth, CO_2=7.19; air supply per berth=1,880 cubic feet per hour.

B. *Steel cars (constructed without deck sashes).*

Exhaust ventilation:

Body of car, CO_2=5.90[8]; air supply to car=53,000 cubic feet per hour.
Lower berth, CO_2=6.76; air supply per berth=2,170 cubic feet per hour.
Upper berth, CO_2=7.00; air supply per berth=2,000 cubic feet per hour.

The comparisons made in the preceding summary will be made clearer by consulting chart 1, in which the CO_2 and the equivalent

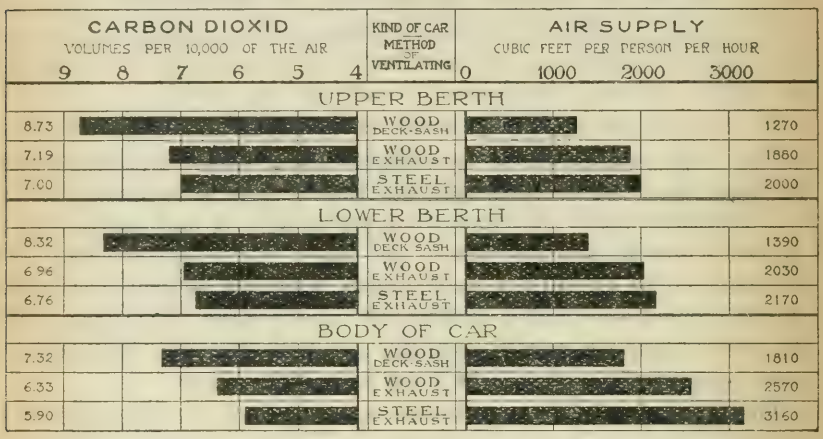


CHART 1.—Comparative CO_2 and air supply of the berths and aisle in steel cars with exhaust ventilation and in wood cars with exhaust and natural ventilation.

hourly air supplies per person are grouped for the three classes of cars, showing their relations as established by a study of the air of the aisle, the lower berth, and the upper berth, respectively.[9]

The preceding determinations of CO_2 and computations of air supply refer to the running car. When a train stops the active ventilation is much reduced and the CO_2 rises. It may finally reach a maximum of 20 volumes in 10,000, though it usually stops around 15. This rise in the CO_2 is generally detected within a very short time—one or two minutes. Upon starting again the air supply is increased and the CO_2 falls rapidly. In working out the series of observations presented in this and the previous study no attention was paid to stops lasting up to four or five minutes; samples taken after those of longer duration have been dropped out of consideration. Had attention been confined strictly to the running car, the results would

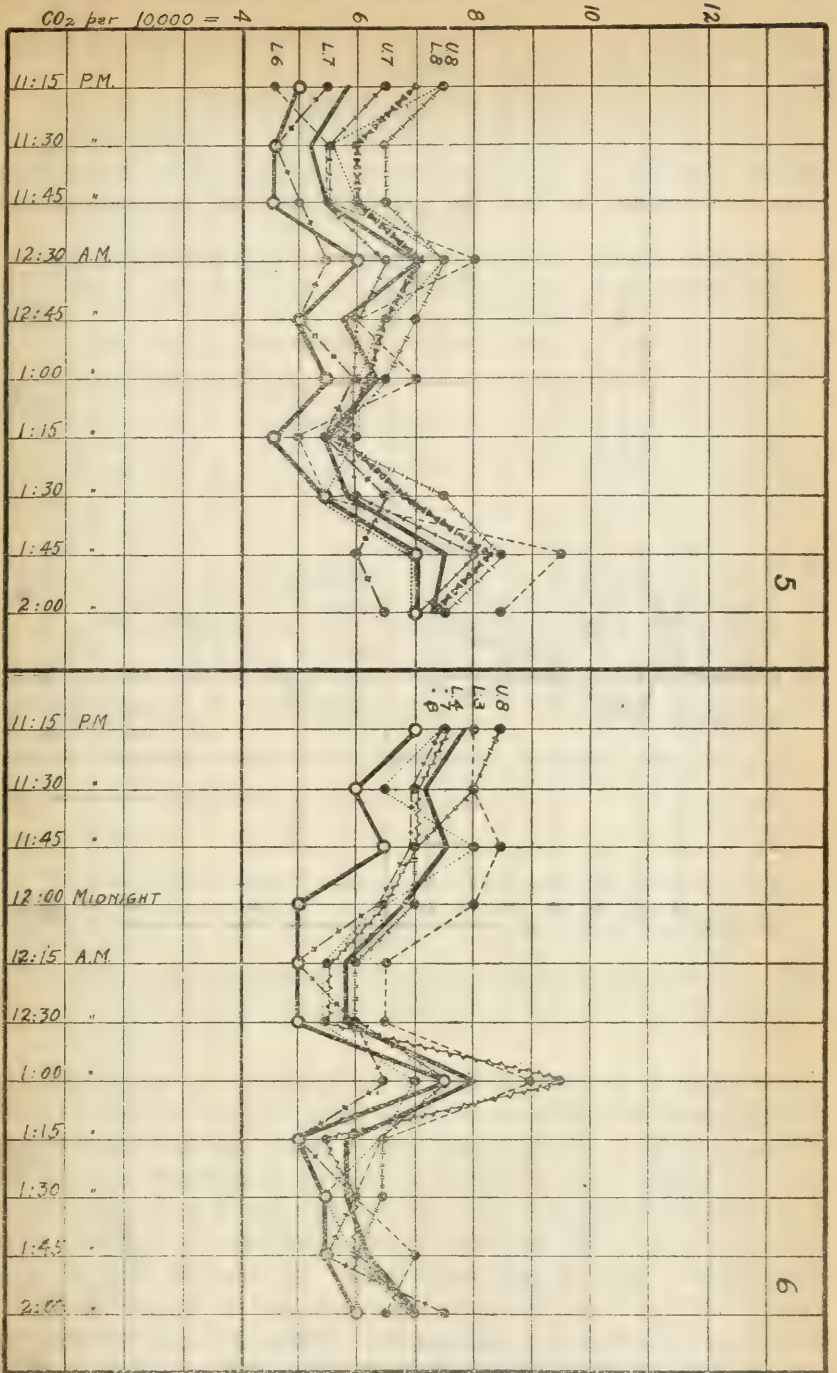


CHART 2.—Graphic representation of experiments 5 and 6, showing consistent relation of CO_2 in aisle and berths. The lower heavy line represents the findings in the aisle, the upper heavy line the average in the lower berth, and the heavy broken line the average in the upper berth. The thin broken lines trace the findings in individual berths. The relation shown here is that which usually obtains.

be changed slightly; the CO_2 would be a little lower and the equivalent air supply proportionately higher.

As a general rule, it is found that the CO_2 in the air of the berths and of the aisle follow each other consistently in successive determinations; that of the berths averaging a little higher, as would be expected from the fact that the inflowing air from end passageways

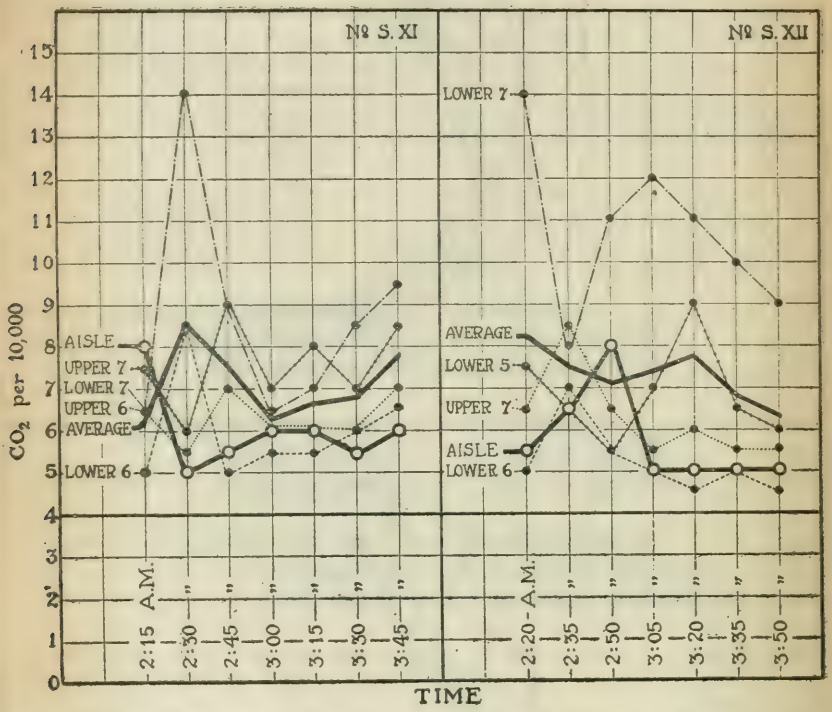


CHART 3.—Graphic representation of experiments 11 and 12, showing inconsistent relation of CO_2 in aisle and berths. The lower heavy line connecting open circles represents the findings in the aisle, the upper heavy line the average for the berths. The lighter lines represent individual berths.

is not likely to enter them, but to be mixed in the aisles with the contaminated air that flows out from them. This consistency is well shown in chart 2, where experiments 5 and 6, selected because they show the longest series of determinations, are graphically represented. The relation represented in this chart is that which generally obtains, though it occasionally happens that the findings are so varied as to show little if any of such consistency. By far the most striking example of this I am able to produce is shown in chart 3, where experiments 11 and 12 are represented. These two cars were on the same train and were examined at approximately the same time. Two lower berths are here represented where the CO_2 momentarily reached

14 parts per 10,000 of air, the only instances but one in which it passed 12. It should be noted also that lower berth No. 7, shown at the right, shows the highest average CO_2 (10.71 per 10,000) of any berth of the whole series. It is the only one reaching an average of 10 parts per 10,000, except one berth in experiment 22, where they all ran much above the general average.

From what has preceded, it is seen that the air supply to the breathing zone of the steel car, constructed without deck sashes, is materially increased over that of cars similarly equipped as to exhaust ventilating devices, but built with deck sashes in the ordinary way. This increased ventilation is much more noticeable in the air of the aisles than in that of the berths; it results in a somewhat greater difference between the CO_2 of the aisle and berths than was found in the previous series, which is interpreted to mean that more air flows from the end doors and passageway windows into the body of the car by reason of there being no crevices at the top to supply the exhaust demand of the ventilators. It is, however, probable that the power of exhaustion developed by these ventilators is very slight as measured by differences of the internal and external barometric pressure. They no doubt act mainly by furnishing a ready exit and continuous outflow of that air forced in by the wind, preventing its damming back near the places of entrance. In this way a constant upward movement of the incoming air is assured, and this leads to a constant and equalized renewal of the air in the lower levels.

HYGIENIC CONSIDERATIONS.

The principles which should govern the application of ventilating procedures, and the more important experimental evidence upon which these are based, have been previously discussed.[10] It is not necessary to make further reference to the history and literature of the subject in this place.

Until very recent years our knowledge of the hygienic principles of ventilation has been exceedingly imperfect, and our opinions largely erroneous. It must be confessed that the subject is still in a rather chaotic condition; but order is beginning to come out of this chaos, if, indeed, it is not already fully established for those who have carefully studied the excellent experimental work of many investigators who have busied themselves to answer questions concerning why we must ventilate, what are its effects, how are these produced, and upon what failures depend. Failures there have been without number, and these too, when, according to the hygienists, the requisite quantity of pure air was introduced. It took the phys-

iologists to answer our questions and to rid us of old and erroneous conceptions. The subject has been most clearly set forth, and much valuable experimental evidence has been added, in a recent communication to the Royal Society of Arts by Prof. Leonard Hill,[11] of London.

Upon the basis of well-controlled experiments, the following statements seem to be entirely warranted:

1. All trustworthy evidence goes to show that the normal expired air contains no volatile poison[12] and that it is not capable of harming the human organism when rebreathed under the ordinary conditions of ventilation.

2. The increase of carbon dioxide and the decrease of oxygen have nothing to do with the ventilation problem under normal conditions or with the subjective or objective effects of close air. Carbon dioxide is a necessary constituent of the air of the lungs; it is not to be considered as a poison or the index of a poison; it is a convenient and fairly accurate index of the quantitative air supply.

3. Air performs for the human body a physical function (heat abstraction) which is quite as important as its chemical function (oxygen supplying).

4. The ordinary defects of ventilation lie with the physical function of the air and not with the chemical.

5. Temperature, humidity, and air movement are the physical qualities which are of greatest importance in this relation.

6. The success of ventilation depends upon whether or not these physical qualities of the air are so regulated as to maintain its physical function of heat abstraction without embarrassment to the reflex mechanism for the regulation of body temperature. "The good effects of efficient ventilation and of outdoor air depend on the coolness, the relative humidity and the motion of the air, and the ceaseless variation of these qualities." (Hill.)

These six statements, then, are the main items of the code which should govern attempts to ventilate. We may not go into the practical details of their application here, but it will be noted that quantity of air as a measure of ventilation efficiency is to a large degree lost sight of, while the physical qualities of the air as they affect its ability to absorb body heat come strongly forward. The hygienic value of ventilation for the purpose of supplying chemically pure air is much less than has been generally supposed. It should now be looked upon as a process to be carried out in the interest of the heat economy of the body. Metabolism is greatly influenced by the rapidity of heat dissipation and this is controlled by external physical conditions.

The great purpose of ventilation is the maintenance of health. This is, in general, accomplished by the maintenance of comfort, for

to maintain a comfortable atmosphere is practically to maintain a healthful one. To this end the regulation of temperature and air movement are of the greatest interest and importance. As to the necessity of adding humidity to naturally dry air which has not been superheated we really know very little. Prof. Hill [11] has expressed the opinion that slight but constant changes of temperature and motion in the surrounding medium, leading to constant readjustments of the heat-regulating mechanism of the body, are a very important factor in obtaining good results; and he very justly objects to the impulsion of hot air into a room as "the most objectionable of all systems of ventilation." He believes that "a cool air and radiant heat are the ideal." Cold air entering in small jets, and direct radiation, with the irregular and constantly changing convection currents, fulfill the desired conditions well.

It is on such a basis of cause and effect that cars ventilated by the method we have been considering are found to be effectively ventilated from the standpoint of air comfort and the feeling of bodily well-being. The air supply is always adequate to prevent monotony and stagnation in the aerial envelope of the skin, yet the streams of incoming cold air are individually of such small volume and take on such irregular and diffuse movement into the stiller body of air within that the discomfort of draughts is almost entirely avoided. There was no report of discomfort—of so-called "stuffiness"—in the series of cars herewith presented. It will be seen by consulting the tables that their temperatures were always low. When trouble arises, it is invariably connected with too much heat. When the temperature is low, ventilation always seems to be good, regardless of the amount of respiratory contamination; when the temperature is high, ventilation always seems to be bad, regardless of the chemical purity of the air. These are statements which have been amply verified by a long list of observations; comfort and air purity have little or no relation, but comfort and air temperature and motion are very closely related. The delicate sensory nerves of the skin have much to do with the feeling of comfort or discomfort. The judgment arrived at by means of our sensations is in the main a correct one; the air is bad or it is good, just as the sensations indicate, but it is bad or it is good in a physical and not in a chemical sense.

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[1] Crowder: A Study of the Ventilation of Sleeping Cars, Arch. of Int. Med., 1911, vii, 85–133.

[2] The Garland Exhaust Ventilator. This is described in the Railway Age, 1906, xli, 847, and in the Railway Age-Gazette, 1910, l, 1757.

[3] The problem is simple. The air supply is inversely as the respiratory contamination. It may be computed from the following equation:

$$A = \frac{vp}{x - N}$$

where v=the CO_2 produced by one person (cu. ft. per hour),
p=the number of people in the car,
x=the proportion of CO_2 found in the air of the car,
N=the proportion of CO_2 in the outside air,
and A=the air supply to the car (cu. ft. per hour).

It is seen that vp is the CO_2 produced by the occupants and $x-N$ is the respiratory contamination. We may substitute known values for the letters v and N in the above equation. The amount of CO_2 produced by one person will average very close to 0.6 cubic foot per hour, and the average proportion of CO_2 in the air surrounding trains has been found to be very close to 0.0004, or 4 parts in 10,000.[3] Making the substitution the equation becomes:

$$A=\frac{0.6\,p}{x-0.0004}$$

Completing the computation of air supply for various assumed proportions of CO_2 the results would be, when the space is occupied by one person only, i. e., when p is the unit 1, as follows:

CO_2=0.0020 (resp. contam.=0.0016), hourly air supply= 375 cubic feet.
CO_2=0.0016 (resp. contam.=0.0012), hourly air supply= 500 cubic feet.
CO_2=0.0012 (resp. contam.=0.0008), hourly air supply= 750 cubic feet.
CO_2=0.0010 (resp. contam.=0.0006), hourly air supply=1,000 cubic feet.
CO_2=0.0009 (resp. contam.=0.0005), hourly air supply=1,200 cubic feet.
CO_2=0.0008 (resp. contam.=0.0004), hourly air supply=1,500 cubic feet.
CO_2=0.0007 (resp. contam.=0.0003), hourly air supply=2,000 cubic feet.
CO_2=0.0006 (resp. contam.=0.0002), hourly air supply=3,000 cubic feet.
CO_2=0.0005 (resp. contam.=0.0001), hourly air supply=6,000 cubic feet.

These same figures apply to a room with any number of occupants provided we add "per person" after "hourly air supply." In order for the air to maintain a constant respiratory contamination the volume supplied must be multiplied as often as we multiply the occupants—the air supply must maintain a constant ratio to the CO_2 produced. Each person will contaminate 1,000 cubic feet of air per hour to the extent of 6 parts of CO_2 in 10,000 of air (and the total CO_2 will be 10 parts in 10,000). One person will need simply the 1,000 cubic feet per hour if the contamination is to be held at this level; 50 will need 1,000 cubic feet each, or 50,000 cubic feet. The estimation of air supply to a car must be based on the total amount of CO_2 produced by all of its occupants.

[4] The end door of the car is fitted with a small sliding window, which may be lowered from the top and held at any level by a catch. These windows are commonly referred to as "drop sashes." In regular service it is customary to maintain a variable opening of these windows in order to facilitate the entrance of fresh air from the vestibule. During the first 10 experiments they were let alone as found: in all later experiments they were purposely kept closed while observations were being made.

An examination of Table I will show that only twice—namely, in experiments 9 and 10—was the air supply markedly affected by these open drop sashes, and in these cars the sashes were opened widely. These two cars were on the same train, and air samples from the two were collected at approximately the same time. The air supply in these two instances is so greatly increased as to show a considerably higher average air supply and lower CO_2 for the small group of 8 cars which had some opening of the drop sashes than for the others in which there was no opening at all. The averages for the eight cars are: CO_2, 5.34; occupants, 14.7; equivalent air supply, 65,900 cubic feet per hour. The

averages for all other cars, which had no openings in the end doors, are: CO_2, 5.90; occupants. 16.8; equivalent air supply, 53,000 cubic feet per hour. Leaving out of consideration only Nos. 9 and 10. the other 34 cars show the following averages: CO_2, 5.85; occupants, 16.3; air supply, 53,000 cubic feet per hour. It is seen that the final results are affected only slightly by including in the general averages the findings in these two cars.

The general averages, as above noted and as used throughout, are found by adding together all single observations and dividing by the total number and not by adding the car averages. The two methods will often give slightly different results. but the difference has never been found great enough to make material changes.

[6] These figures may be converted into terms of air supply. For every proportion of CO_2 in the air there is an equivalent hourly air supply. When the CO_2 is 6 per 10,000 there is a dilution of the expired air which would be maintained by 3,000 cubic feet of fresh air per hour; when the proportion of CO_2 is less than 6 per 10,000 there must be more than 3,000 cubic feet per hour. The conversion gives the following results:

	Per cent.
Lower berths showing 3,000 or more cubic feet per hour	44.39
Lower berths showing 2,000 or more cubic feet per hour	72.20
Lower berths showing 1,500 or more cubic feet per hour	84.00
Lower berths showing 1,000 or more cubic feet per hour	97.90
Lower berths showing 750 or more cubic feet per hour	99.65

[6] These cars were Nos. 13, 22, and 23. The last two were on the same train, and samples were taken in them at approximately the same time. The train was running directly with a strong wind. Nos. 13 and 22 are the same car, on different trips.

[7] Converting these figures into terms of air supply as in Note 5:

	Per cent.
Upper berths showing 3,000 or more cubic feet per hour	32.84
Upper berths showing 2,000 or more cubic feet per hour	59.90
Upper berths showing 1,500 or more cubic feet per hour	83.57
Upper berths showing 1,000 or more cubic feet per hour	97.58
Upper berths showing 750 or more cubic feet per hour	100.00

[8] This figure applies to cars which have no opening of the drop sash in end doors, as the equivalent figures in the other groups apply to cars with closed doors. The windows are closed in all cases.

[9] Strictly, there is no proper comparison of the aisles as set forth in this chart, because the number of passengers varied for the different classes of cars, and as this number varies the CO_2 and the volume of air per person will also vary in like ratio with any given air supply to the car. The variation in the average number of passengers for the different classes was, however, so small as to make this direct comparison allowable. In the steel cars from which the figures are drawn the average was 16.3; in the wood cars with exhaust ventilation, 15.7; and in the wood cars with natural ventilation, 16.4; from which it is seen that the comparison is correct to within a small fraction. This is not greater than the unavoidable error of observation.

[10] In the article referred to in Note 1, and in the Report of the Committee on the Ventilation of Cars, Transactions of the Section on Preventive Medicine and Public Health of the American Medical Association at the Sixty-second Annual Session, A. M. A., Chicago, 1911, p. 177.

[11] Hill and Flack: The Influence of Ozone in Ventilation, Jour. of the Royal Society of Arts, London, Feb. 9, 1912, lx, p. 344.

[12] Mention should be made in this connection of the recent work of Rosenau and Amoss, Organic Matter in the Expired Breath (Jour. of Med. Research, 1911, xxv, p. 35). Upon the basis of the very delicate anaphylactic reaction they have made experiments which would seem to indicate that organic bodies belonging to the protein group may be present in the breath of healthy people, and they express the opinion that these bodies may be harmful when rebreathed.

In the air of the lungs any such volatile proteid would be constantly present in 50 or 100 times greater concentration than in the air of occupied rooms, since the air of such rooms does not ordinarily contain more than 1 or 2 per cent of expired air. The air which has been expelled from the alveoli and has lodged in the upper air passages during expiration, is drawn back into the alveoli during inspiration. The volume of this "dead space" amounts to about one-third of the volume of normal inspiration; consequently, the normally inspired air is about one-third expired breath.

The reinspiration of expired air appears to be a conservative and a necessary process. It is a well-known fact that the pulmonary ventilation is increased and decreased reflexly to maintain a relatively constant pressure of CO_2 (about 5 per cent of an atmosphere) in the alveolar air. Our hypothetical poison could not become concentrated in the surrounding air unless the CO_2 also became concentrated, and then the larger respiratory ventilation due to the increased CO_2 would affect the concentration of both bodies in the alveolar air in equal proportion. The increase in pulmonary ventilation which would be made necessary by the presence of 2 or 3 per cent of expired air in that which is being breathed, in order to mantain what we must, in the nature of things, look upon as the normal dilution of the alveolar air is very small. It amounts to no more than 3 or 4 per cent, whereas the possible increase is as many hundred per cent. Such an increase ought to lie well within our "margin of safety."

VORSCHRIFTEN FÜR DIE DESINFEKTION DER STRASSEN- UND EISENBAHNWAGEN.

Sanitätsrat Dr. GUSTAV WAGNER, Hilfsarbeiter im Königlich Preussischen Ministerium der öffentlichen Arbeiten, Vertrauensarzt der Königlichen Eisenbahn-Direction, Berlin, Germany.

Das Gesetz, betreffend die Bekämpfung gemeingefährlicher Krankheiten, vom 30. Juni 1900 ist die Grundlage aller derjenigen Verordnungen, welche im Deutschen Reich getroffen sind, um auch im Verkehr mit rollendem Material jede Gefahr für Verbeitung von ansteckenden Krankheiten nach Möglichkeit zu verhindern.

Um aber die notwendigen Vorkehrungsmassregeln treffen zu können, ist es vor Allem notwendig, die Kenntnis von dem Vorkommen einer Erkrankung zu erhalten, deshalb hat der Gesetzgeber an die Spitze des Gesetzes die Anzeigepflicht gesetzt. Der Schluss des § 1, welcher von der Anzeigepflicht handelt, sieht es aber schon vor, dass die Möglichkeit des Ortswechsels die Gefahr der Verschleppung der Krankheit heraufbeschwört. Er bestimmt daher: "Wechselt der Erkrankte den Aufenthaltsort, so ist dies unverzüglich bei der Po-

lizeibehörde des bisherigen und des neuen Aufenthaltsortes zur Anzeige zu bringen."

§ 15 des Gesetzes bestimmt: " Die Landesbehörden sind befugt, für Ortschaften und Bezirke, welche von einer gemeingefährlichen Krankheit befallen oder bedroht sind, * * * 4. die in der Schiffahrt, der Flösserei oder sonstigen Transportbetrieben beschäftigten Personen einer gesundheitspolizeilichen Ueberwachung zu unterwerfen und kranke, krankheits- oder ansteckungsverdächtige Personen sowie Gegenstände, von denen anzunehmen ist, dass sie mit dem Krankheitsstoffe behaftet sind, von der Beförderung auszuschliessen."

§ 19 besagt: " Für Gegenstände und Räume, von denen anzunehmen ist, dass sie mit dem Ansteckungsstoffe behaftet sind, kann eine Desinfection angeordnet werden.

" Für Reisegepäck und Handelswaren ist bei Aussatz, Cholera und Gelbfieber die Anordnung der Desinfection nur dann zulässig, wenn die Annahme, dass die Gegenstände mit dem Krankheitsstoff behaftet sind, durch besondere Umstände begründet ist."

§ 20 erwähnt zum Schutz gegen die Pest Massregeln zur Vertilgung und Fernhaltung von Ratten, Mäusen und anderem Ungeziefer.

§ 24 handelt von den Massregeln zur Verhütung der Einschleppung der gemeingefährlichen Krankheiten aus dem Auslande: Verbot oder Beschränkung des Einlasses von dem Personen- oder Frachtverkehr dienenden Fahrzeugen u. s. w.

Das Preussische Gesetz betreffend die Bekämpfung übertragbarer Krankheiten vom 28. August 1905 überträgt dem Staatsministerium die Ermächtigung, die genannten Verkehrsbeschränkungen auch bei Körnerkrankheit, Rückfallfieber und Typhus eintreten zu lassen. Desinfection ist nach diesem Gesetz vorgeschrieben bei Diphtherie, übertragbarer Genickstarre, Kindbettfieber, Körnerkrankheit, Rückfallfieber, Ruhr, Scharlach, Typhus, Milzbrand und Rotz.

Als gemeingefährliche Krankheiten gelten, um das noch nachzutragen: Aussatz (Lepra), asiatische Cholera, Fleckfieber, Gelbfieber, Pest und Pocken.

Für die Tuberkulose sind besondere Vorschriften erlassen durch die Ausführungsbestimmungen zu dem Preussischen Seuchengesetz.

Die Eisenbahn-Verkehrsordnung bestimmt: " Die Beförderung von Pestkranken ist ausgeschlossen. An Aussatz, Cholera, Fleckfieber, Gelbfieber oder Pocken erkrankte oder einer dieser Krankheiten verdächtige Personen werden nur dann zur Beförderung zugelassen, wenn die beizubringende Bescheinigung des für die Abgangsstation zuständigen beamteten Arztes dies gestattet; sie sind in besonderen Wagen zu befördern; für Aussätzige und des Aussatzes Verdächtige genügt eine abgeschlossene Wagenabteilung mit getrenntem Aborte." Letztere Vorschrift gilt auch für an Typhus, Diphtherie, Scharlach, Ruhr, Masern oder Keuchhusten leidende Personen.

Der Wagen, in welchem ein Cholera-, beziehungsweise Pocken-, beziehungsweise Fleckfieberkranker sich befunden hat, ist sofort ausser Dienst zu stellen und der nächsten geeigneten Station zur Desinfection zu übergeben.

Die Anweisung über die Behandlung der Eisenbahn-, Personen- und Schlafwagen bei Cholera-, beziehungsweise Pest-, beziehungsweise Pocken-, beziehungsweise Fleckfiebergefahr lautet: 1. Während eines Cholera-, beziehungsweise Pest-, beziehungsweise Pocken-, beziehungsweise Fleckfieberausbruchs im Inlande oder in einem benachbarten Gebiet ist für besonders sorgfältige Reinigung und Lüftung der dem Personenverkehr dienenden Wagen Sorge zu tragen: es gilt dies namentlich in Bezug auf Wagen der 3. und 4. Klasse, welche zur Massenbeförderung von Personen aus einer von der Cholera, beziehungsweise der Pest, beziehungsweise den Pocken, beziehungsweise dem Fleckfieber ergriffenen Gegend gedient haben.

Zusatz bei Cholera: Die in den Zügen befindlichen Bedürfnisanstalten sind regelmässig zu desinfizieren und zu dem Zwecke die Trichter und Abfallrohre nach Reinigung mit Kalkmilch zu bestreichen, die Sitzbretter mit Kaliseifenlösung zu reinigen (vergleiche Ziffer 2).

2. Ein Personenwagen, in welchem ein Cholera-, beziehungsweise Pest-, beziehungsweise Pocken-, beziehungsweise Fleckfieberkranker sich befunden hat, ist sofort ausser Dienst zu stellen und der nächsten mit den nötigen Einrichtungen versehenen Station zur Desinfection zu überweisen, welche in nachstehend angegebener Weise zu bewirken ist.

Etwaige grobe Verunreinigungen im Innern des Wagens sind durch sorgfältiges und wiederholtes Abreiben mit Lappen, welche mit Karbolsäurelösung befeuchtet sind, zu beseitigen. Alsdann sind die Läufer, Matten, Teppiche, Vorhänge und beweglichen Polster abzunehmen, in Tücher, welche mit Karbolsäurelösung stark angefeuchtet sind, einzuschlagen und der Dampfinfection zu unterwerfen. Ein vorheriges Ausklopfen dieser Gegenstände ist zu vermeiden. Gegenstände aus Leder, welche eine Dampfdesinfection nicht vertragen, sind mit Karbolsäurelösung gründlich abzureiben. Demnächst ist der Wagen durchweg einer gründlichen Reinigung zu unterwerfen, wobei seine abwaschbaren Teile mit Karbolsäurelösung zu behandeln sind, und sodann in einem warmen, luftigen und trocknen Raume mindestens drei Tage aufzustellen.

Die bei der Reinigung verwendeten Lappen sind zu verbrennen.

Zur Herstellung der Karbolsäurelösung wird 1 Gewichtsteil verflüssigte Karbolsäure (Acidum carbolicum liquefactum des Arzneibuchs für das Deutsche Reich) mit 30 Gewichtsteilen Wasser gemischt.

Zusatz bei Cholera: Zur Herstellung von Kalkmilch wird 1 Raumteil frisch gebrannter Kalk (Aetzkalk, calcaria usta) mit 4 Raumteilen Wasser gemischt, und zwar in folgender Weiss: Der Kalk wird in ein geeignetes Gefäss gelegt und zunächst mit $\frac{3}{4}$ Raumteilen Wasser durch Besprengen unter stetem Umrühren gelöscht. Nachdem der Kalk zu Pulver zerfallen ist, wird er mit dem übrigen Wasser zu Kalkmilch verrührt.

Zur Herstellung von Kaliseifenlösung werden 3 Gewichtsteile Seife (sogenannte Schmierseife oder grüne Seife oder schwarze Seife) in 100 Gewichtsteilen siedend heissen Wassers gelöst (z. B. $\frac{1}{2}$ Kg. Seife in 17 Litern Wasser). Die Lösung ist heiss zu verwenden.

3. Ist ein Schlafwagen von einem Cholera-, beziehungsweise Pest-, beziehungsweise Pocken-, beziehungsweise Fleckfieberkranken benutzt worden, so muss die während der Fahrt gebrauchte Wäsche desinfiziert werden. Zu diesem Zwecke ist sie in Tücher, welche mit Karbolsäurelösung stark befeuchtet sind, einzuschlagen und alsdann so in ein Gefäss mit Karbolsäurelösung zu legen, dass sie von der Flüssigkeit vollständig bedeckt wird; frühestens nach zwei Stunden ist dann die Wäsche mit Wasser zu spülen und zu reinigen. Zur Wäsche sind zu rechnen: Die Laken, die Bezüge der Bettkissen und der Decken sowie die Handtücher. Die Desinfection des Wagens selbst hat in der unter Ziffer 2 vorgeschriebenen Weise zu erfolgen; dabei sind jedoch auch die von dem Kranken benutzten Bettkissen, Decken, und beweglichen Matratzen in der dort angegebenen Weise einzuschlagen und alsdann der Dampfdesinfection zu unterwerfen. Statt der Desinfection mit Karbolsäurelösung kann die Wäsche auch der Dampfinfection unterworfen werden.

Für den Fall, dass es sich als notwendig erweisen sollte, einen Schlafwagenlauf gänzlich einzustellen, bleibt Bestimmung vorbehalten.

4. Die vorstehenden Bestimmungen finden sinngemässe Anwendung bei Erkrankungen von Zug- und Postbeamten in den von ihnen benutzen Gepäck- und Postwagen.

Zusatz bei Pocken: Zur Reinigung und Desinfection dürfen nur solche Personen verwendet werden, welche die Pocken überstanden haben oder sich sofort der Impfung oder Wiederimpfung unterwerfen.

5. Die mit der Desinfection beauftragten Arbeiter haben jedesmal, wenn sie mit inficierten Dingen in Berührung gekommen sind, die Hände durch sorgfältiges Waschen mit Karbolsäurelösung zu desinfizieren und sich sonst gründlich zu reinigen. Es empfiehlt sich, dass die Desinfectoren waschbare Oberkleider tragen; diese sind in derselben Weise wie die Wäsche aus den Schlafwagen zu desinfizieren.

Diese Gesetze geben eine Gewähr dafür, dass Seuchen und übertragbare Krankheiten an ihrer Verbreitung nach Möglichkeit verhindert werden, doch kommt es auf die Ausführung derselben und besonders auf eine sachgemässe und erfolgreiche Desinfection an.

Es hat sich nun bei der Ausführung der Desinfection herausgestellt, dass es nicht möglich ist, durch die gewöhnlichen Desinfectionsmassregeln eine vollkommene Keimfreiheit namentlich in den mit Polsterungen versehenen Wagen zu erzielen, ohne dass das Material, das desinfiziert werden soll, immer vor Schaden oder Vernichtung bewahrt wird. Deshalb ist die Preussisch-Hessische Eisenbahnverwaltung dazu übergegangen, in möglichst luftleerem Raum durch Austrocknung unter Zuführung von Formalindämpfen die Keime abzutöten. Gleichzeitig dient diese Art der Desinfection ganzer Wagen auch der Abtötung makroskopischen Ungeziefers und seiner Eier. Die Einschleppung desselben ist bei dem internationalen Charakter des Verkehrs selbst in den Wagenklassen, welche begütertere Personen zu benutzen pflegen, nicht zu vermeiden.

Diese Desinfection ganzer Eisenbahn-Personenwagen wird durch einen in der Hauptwerkstatt Potsdam aufgestellten Desinfectionsapparat, der mit einem Kostenaufwand von rund 79–80,000 M. von der Firma Julius Pintsch, Aktiengesellschaft in Berlin hergestellt ist, bewirkt.

Auch zu Zwecken der Austrocknung von Hölzern oder Wagenteilen und dergleichen Massregeln, die sich im Betriebe der Eisenbahn-Werkstätte oft als notwendig herausstellen, ist der Apparat gut zu verwenden.

Der Apparat besteht aus einer zylindrischen, gusseisernen Kammer, in welche der Eisenbahnwagen auf Schienen hineingeschoben wird. Die Länge dieser Kammer beträgt etwa 23 Meter und der lichte Durchmesser 5 Meter.

Die Kammer kann durch eine Luftpumpe nahezu luftleer gemacht werden. Dementsprechend ist die Stärke der Wandungen bemessen. Ebenso ist dafür gesorgt, dass die Eigenlast der eingeschobenen Wagen nicht imstande ist, eine Deformation der Kammer zu verursachen. Geschlossen ist die Kammer an der Hinterwand mit einer festen, nach innen gewölbten, teils geschweissten, teils genieteten Flusseisenblechkappe. Eine gleiche Kappe, die jedoch durch einen vor der Einfahrtsöffnung aufgestellten Krahn von einem Manne bewegt werden kann, dient zum Verschluss der Einfahrtsöffnung und wird durch Klappschrauben an den Rand des Langkessels gedrückt.

Durch ein an der Seite des Langkessels angebrachtes starkes Fensterchen kann man ein in dem Innern des Kessels angebrachtes Thermometer beobachten, welches die in dem Innern entwickelte Wärme anzeigt. Die Erwärmung des Innenraumes geschieht durch Heizschlangen, welche an den Innenwänden des Kessels halbring-

förmig herumlaufen. Der Dampf tritt in diese Heizschlangen durch ein oberes durch den Kessel laufendes und mit ihnen verbundenes Hauptrohr ein. Hierdurch kann das Innere des Kessels auf + 60 Grad C-erwärmt werden. Die normale Wärme von +50 Grad, welche beim Betrieb des Apparates ständig erhalten wird, wird in einer Stunde erreicht, während ein vollständiges Durchwärmen des eingeschobenen Wagens erst nach ungefähr 5 Stunden erreicht wird. Dies ist die Temperatur, welche nicht überschritten werden darf, sollen nicht die lackierten und polierten Teile des Wagens beschädigt werden.

Das zur Desinfection notwendige Formalin—5 Kg. sind notwendig für einen Wagen—wird aus dem Verdamfer im Innern des Kessels durch Schläuche bei in die Höhe gezogenen Fenstern durch die Ventilationsklappen gegen die Decke des Wagens geleitet, um hier zuerst, bevor es zum Boden sinkt, etwaige Keime anzutöten. Es hat sich nämlich durch Versuche, welche das Kaiserliche Reichsgesundheitsamt anstellte, und die noch nicht abgeschlossen sind, herausgestellt, dass Keime an der Decke nicht getötet wurden, wenn das Formalin durch die geöffneten Fenster an ihrem unteren Teil eingeleitet wurde. Das Formalin sank zu Boden und erreichte mit seiner abtötenden Wirkung nicht die unter der Decke oder in den Gepäcknetzen untergebrachten Keime.

Unter der Einwirkung der Erwärmung, der Luftverdünnung und des Formalins verbleibt der Wagen bis zu 12 Stunden. Vor dem Oeffnen wird durch ein Ventil Luft in die Kammer gelassen.

Jede andere Desinfection hat sich als viel teurer herausgestellt, ohne eine grössere Sicherheit für Gewährleistung vollkommener Abtötung aller Keime zu bieten.

Zur Bedienung ist nur ein Mann notwendig.

Unter Berücksichtigung der Beträge für Verzinsung des Anlagekapitals und der Amortisation betragen die Kosten für die Desinfection eines Wagens etwa 35 M., ohne die genannten Beträge 20 M.

Die früher betriebene Reinigung der Wagen beanspruchte das zehnfache an Lohnausgaben, ohne eine Sicherheit für eine einwandfreie Reinigung zu geben.

An einem Arbeitstage können durch den Apparat zwei Wagen vollkommen desinfiziert werden. Das ist natürlich nicht ausreichend für das gesamte rollende Material der Verwaltung. Es ist daher das Bestreben nur zu begrüssen, ausser dem einen Apparat in Potsdam noch weitere 4 Apparate an dem 4 äussersten Ecken des Verwaltungsbezirke aufzustellen, wenn erst die Versuche des Reichsgesundheitsamtes zum Abschluss gekommen sein werden.

Die zentrale Lage des jetzigen Apparates ist zu Versuchszwecken sehr geeignet. Für den praktischen Gebrauch dürfte es sich aber ganz besonders empfehlen, auch noch an denjenigen Orten Apparate

aufzustellen, an welchen die Wagen die Grenzen eines Nachbarlandes überschreiten.

Die Desinfection der Strassenbahnwagen unterliegt den nach den Verschriften des Reichsgesetzes, betreffend die Bekämpfung gemeingefährlicher Krankheiten vom 30. Juni 1900, und des Preussischen Gesetzes, betreffend die Bekämpfung übertragbarer Krankheiten vom 28. August 1905, erlassenen polizeilichen Verordnungen der einzelnen Gemeinden, ebenso die aller übrigen Fuhrwerke.

Der Desinfection von Automobilen und anderen Fuhrwerken stehen dieselben Schwierigkeiten gegenüber wie der Desinfection ganzer Eisenbahnwagen, mag es nun sich um frei oder auf Schienen laufende handeln. Für Strassenbahnwagen müssen ähnlich grosse Desinfectionsapparate beschafft werden, wie für Eisenbahnwagen.

Der nächstliegendste Gedanke war für Krankenwagen derartige Apparate zu beschaffen. Natürlich traten diesem Gedanken die Städte näher, welche das Krankentransportwesen städtisch organisiert hatten durch Beschaffung städtischer Krankenwagen und Krankenautomobile, welche durch Mannschaften der Feuerwehr bedient werden. Die Notwendigkeit, diese städtischen Fuhrwerke ständig desinfiziert zu erhalten, musste zu der Erbauung einer Desinfectionsanlage für ganze Wagen führen. So hat denn die Stadt, in der ich die Ehre hatte, als Stadtrat die Uebernahme des Krankentransportwesens in staedtische Verwaltung in die Wege zu leiten und auszuführen, den weiteren Schritt getan und eine Desinfectionsanstalt für ganze Wagen errichtet, in erster Linie für ihre Krankenwagen und Krankenautomobile, dann aber auch für andere dem öffentlichen Verkehr dienende Fuhrwerke, die ja auch dem Desinfectionszwang unterliegen.

Diese Stadt, Berlin-Schöneberg, hat von der Firma Lautenschläger in Berlin in ihrer neuerbauten Desinfectionsanstalt einen Wagen- und Automobil-Desinfector aufstellen lassen, welcher nicht den kreisförmigen Querdurchschnitt des Apparates der Firma Pintsch hat, sondern rechteckig mit abgerundeten Ecken ist und bogenförmig ausgeschweifte, nach innen convexe Seiten hat, gewissermassen also aus vier mit einander vereinigten Röhren besteht, deren einander zugekehrte Seiten entfernt sind. Es soll dadurch an Raum gespart und eine grössere Stabilität bei leichterer Ausführung erzielt werden.

Ob dies tatsächlich der Fall ist, darf wohl den Technikern zur Entscheidung überlassen werden. Die Sachverständigen der Königlichen Eisenbahnverwaltung haben sich bisher nicht dafür aussprechen können.

Der Apparat ist in Berlin-Schöneberg erst zu kurze Zeit in Gebrauch, als dass ein endgültiges Urteil darüber abgegeben werden kann. Wie ich höre und wie es auch selbstverständlich erscheint,

werden die Versuche in Berlin-Schöneberg mit Eifer betrieben, um die Leistungsfähigkeit des Apparates festzustellen.

Die Angaben über den Desinfectionsapparat der Königlichen Eisenbahnverwaltung habe ich zum Teil mündlich von Herrn Geheimen Baurat Schumacher in Potsdam erhalten und zum Teil seiner Schrift, "Die Desinfection der Eisenbahn-Personenwagen in den Werkstäten," entnommen. Ich erlaube mir daher ihm, dessen eifrigem Bemühen wir diesen Apparat zum grössesten Teil verdanken, an dieser Stelle meinen aufrichtigen Dank auszusprechen für die Unterstützung, welche er mir bei meinen Bestrebungen, mich zu belehren, zuteil werden liess.

Wenn ich zum Schlusse meiner Ausführungen mir erlauben darf aus dem Gesagten die Nutzanwendung zu ziehen, so fasse ich diese in folgenden Sätzen zusammen:

1. Die Bekämpfung der Seuchen und übertragbaren Krankheiten muss in allen Ländern eine ähnliche gesetzliche Regelung erfahren wie in Deutschland.

2. Insbesondere ist die Desinfection aller dem öffentlichen Verkehr dienenden Fuhrwerke: mit Pferden bespannte Wagen, Automobile, Strassenbahn-, Hoch- und Untergrundbahnwagen gesetzlich zu verlangen.

3. Am besten dienen diesem Zwecke Desinfectionsanstalten für ganze Wagen.

4. Für den Eisenbahnverkehr empfiehlt es sich einen zentralgelegenen Ort mit einem solchen Apparat zu versehen, dann aber auch solche Orte, an denen die Wagen die Landesgrenze überschreiten.

5. Auch in den Städten sind derartige Desinfectionsanstalten für ganze Fuhrwerke, auch für Strassenbahn- und Hoch- und Untergrundbahnwagen zu errichten.

THE HYGIENE OF THE TRANSPORTATION OF ANIMAL-FOOD PRODUCTS BY RAIL, BOAT, AND WAGON IN THE UNITED STATES.

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The hygiene of the transportation of animal-food products is closely allied to the hygiene of storage. A refrigerator vessel is essentially a floating cold-storage warehouse; a refrigerator car, an ambulatory icebox. Therefore, broadly speaking, the principles of hygiene which guide to correct practice in storage will guide to correct practice in transportation.

Nevertheless, it by no means follows that identity of hygienic principle should result in identity of practice. A storage warehouse is

not rigorously limited in height, weight, spaciousness, and all details of construction and management. It possesses a large flexibility of response to hygienic demands. But the vessel and the car, even if used exclusively for refrigerator service, still remain a vessel and a car, and in design, construction, and management must yield to limitations thereby inexorably imposed.

Since, then, neither storage facilities nor hygienic control during transportation can ever equal those possible in stationary storage structures, it follows that the first and distinctive demand of hygiene is rapid transportation. If foods must be exposed to conditions not to be entirely commended, though not to be avoided, the duration of such exposure should be reduced to the minimum.

The further general requirements of hygiene are naturally those common to all storage repositories of food products; first, that only properly selected and prepared goods be received at all; second, the maintenance of cleanliness, dryness, and an even low temperature.

Since the problems involved are preeminently practical ones, we may best proceed by a survey of the methods of transportation in present actual use which do most nearly meet the requirements of hygiene. We may thus not only observe what has been accomplished in this direction, but may likewise become familiar with the practical conditions to be faced, failing which knowledge even the rarest scientific mind is in no strategic position either properly to estimate the present or to improve the future.

The magnitude of the fresh-beef industry, the long distances fresh beef is normally transported, its high money value, its susceptibility to unfavorable conditions, and, lastly, the high quality of product demanded by the average consumer, combine to render the transportation of this commodity illustrative of the best practice in vogue at the present time. Therefore, the transportation of fresh beef has been selected for detailed treatment.

Needless to say, the beef which is the subject of our study has been prepared in an establishment operating under Government inspection, so that the product is assuredly sound and clean. It has been in the cooler, as the packers term their large storage rooms, held at a temperature just above the freezing point of water, until thoroughly chilled throughout, and has been dressed into quarters, each one of which bears in several places the inspection mark of the Bureau of Animal Industry stamped in purple ink.

The refrigerator car in which it is to begin its journey is outwardly, by necessity, of the standard form of ordinary large box car in use in this country. One first notices the difference in the massive tight-fitting doors; next, in the heavy insulated walls; and, finally, in the clean varnished surface of matched boards which line the interior. Parallel rows of galvanized iron piping attached to the

roof will receive hooks from which will hang the meat. At the extreme ends of the car are the ice bunkers, tanks of galvanized iron of varying form, but in any case extending from the roof nearly to the floor. Access to the interior of the ice bunkers is only through hatches on the outside of the roof, and drainage is carried off by pipes through the floor. Thus ice compartments and meat compartments are entirely separate, and the cold air which passes over the meat comes from a galvanized iron surface, and not from melting ice. A board partition across the end of the car several inches in front of the bunkers, but extending to within only about a foot of the floor and roof, protects the meat nearest the bunkers from freezing and promotes circulation of air throughout the interior.

Before use the cars, thoroughly cleaned and aired, are "precooled" by keeping the bunkers filled with a mixture of ice and salt for a day or two, so that at the time of loading the interior temperature is close to or even below the freezing point of water. The car is run beside a platform upon which opens a door from the cooler, and a procession of quarters of beef moves majestically out of the cooler, each quarter swinging from a wheeled hook traveling on an overhead rail. To lift it off, carry it in, and hang it up needs so little time that exposure to an unrefrigerated atmosphere has to be counted in seconds.

Once inside, the beef is packed compactly to prevent chafing when the car is in motion. There is plenty of space at top and bottom for air circulation, and of course innumerable vertical channels between the irregularly shaped quarters. Very commonly the car is not filled solidly with beef, but carries a mixed cargo—dressed lambs, pork cuts, cured and smoked meats, lard—in fact, any of the numerous products of the packing house. This system of loading tends to overcome one drawback to the refrigerator car, namely, different temperatures at different points in the car. Nearest the ice bunkers the temperature may be below freezing, and at this point can be placed such products as either demand or are not injured by a freezing temperature. Again, at the center of the car the temperature may be higher than is desirable for fresh beef but low enough for the storage of such products as lard and cured meats.

Needless to say, the car and every article going into it are subject to inspection by the Bureau of Animal Industry, and a certificate stating that the product has been inspected must be delivered to the railroad company along with the shipment. In the large centers trains are daily made up of such cars gathered from various establishments, and are hurried east, requiring about three days from Chicago to the coast, approximately 1,200 miles. During the trip the cars are three times reiced, with an appropriate mixture of ice and salt, at depots maintained for the purpose, so that the beef arrives at

its destination at a temperature very little, if any, above that at which it left the cooler.

Unloading is simply the reverse of loading, the beef being swung to an overhead rail and run directly into the receiving cooler, subject, of course, to inspection to insure its continued soundness.

In spite of heavy home consumption, some small part of our beef supply still finds its way across the Atlantic Ocean. Its history up to the point of embarkation is as already described, except that it is specially selected from the cooler, so that it may be loaded as fresh killed as possible, and each quarter is smoothly and tightly sewn in a white cloth wrapping. The car is run alongside the vessel, either on the dock or on a float, and the loading, which is preferably in the clean and cool air of night or early morning, is performed by means of a sling of heavy rope netting, handling several quarters at one time. The square netting is spread out flat, and covered with a clean white canvas, upon which the quarters are carefully laid and covered with another canvas. Then the four corners of the netting are caught up to the hook of the hoisting rigging, and the whole is swung up clear, and then lowered through a deck hatch into the hold, where the beef is removed and the sling hoisted out for another load. The vessels are equipped with one or another of the well-known types of refrigerating machines and possess well constructed and properly managed storage compartments. Two disadvantages in comparison with storage warehouses on land may be noted. Owing to the necessity for economy of space, the compartments are cooled by piping about the walls and ceiling, and not from overhead bunkers or pipe lofts, while the meat is closely hung, much as in a refrigerator car. All export meat, of course, receives the same Government inspection as that going into interstate domestic commerce.

In ordinary oceanic trade from this country meat is usually shipped "chilled"; that is, at a temperature just above its freezing point and not in a frozen condition. A notable exception is constituted by meat consigned to certain branches of the Government service—the Army, the Navy, and the Isthmian Canal Commission. All fresh meat for such use, except, of course, that intended for immediate consumption in port, must be frozen solid when delivered to the ship. Large pieces are sewn in white muslin; small cuts are handled in appropriate commercial packages. All must bear the Government inspection stamp. Moreover, every piece taken aboard has to pass on the spot the scrutiny of an official inspector specially detailed to the work and must meet his approval, not only on the score of soundness, but of quality as well, for the specifications state that only the best quality of any meat will be accepted. Meat of such a character, kept solidly frozen after receipt, forms an eminently grateful article of diet on shipboard after many months of storage.

The battleships themselves can carry a considerable supply, and when necessary their storage rooms are replenished from supply ships owned by the Navy Department.

Coming, now, to transportation by wagon, probably the most significant feature is the constantly extending use of motor vehicles. The horse, with his attendant filth and flies, can well be spared from the neighborhood of the packing house and from the front of a wagonload of fresh meat. Better protection to the meat, through the possibility of heavier construction, and far more rapid transit, are other important hygienic advantages of the motor vehicle. The trucks used by large establishments are generally of the van type, with no opening at all in front and with tightly closing doors at the rear. The meat is thus entirely surrounded by wooden walls, which, though not specially insulated, protect it from outer heat as well as from moisture and dirt, so that it may be delivered 30 miles away in prime condition.

For loading the trucks are backed to a platform upon which opens a door from the cooler, and the beef is carried out on the shoulders of men dressed in clean gowns or provided with clean white carrying cloths. The floor of the truck is either strewn with fresh straw or covered with clean canvas, upon which the meat is compactly piled.

At this point, for the first time in its history, the meat is free from direct refrigeration for any appreciable length of time. Meat taken from a cooler into a warmer atmosphere "sweats"; that is, condenses moisture from the atmosphere upon its surface. The surface, previously dry, hard, and nearly impervious to bacteria, now becomes moist and slimy, not only affording an excellent lodging place for bacteria and dirt which may be in the air, but becoming easily penetrable by bacterial growth. The value of the van type of truck is thus apparent, for the confined air of the interior can supply little of either moisture, bacteria, or dirt. Unfortunately, under present conditions it seems necessary to tolerate other types of wagons. But at least one can insist that the wagon be provided with a waterproof cover of canvas or oilcloth, with front and rear flaps of ample size, and securely fastened, so that no direct channels of access to the meat are open.

We have now followed the transportation of fresh beef subject to inspection by the Federal Government. Other fresh carcass meats are handled in essentially the same way. Small cuts, such as pork loins, are wrapped in nonabsorbent paper and crated before shipment. Boxed, barreled, or crated goods, and cured and smoked meats are naturally much less susceptible to outside influences than fresh meat, yet the bulk of such products is handled in practically the same way as fresh meat. Quality and selling value are thus kept at the highest point; and since in any event refrigerator cars and vehicles

of special type must be provided for fresh meats, the large establishments generally find it good business policy to use the same cars and vehicles for practically all their products. When shipments of small cuts of fresh meat must be made over considerable distances and in less than carload lots the ice box is employed. This is a rectangular galvanized-iron box provided with a tight cover and fitting into a similarly shaped but considerably larger wooden box. The space between the two boxes is packed with crushed ice, which may be renewed as occasion demands. Shipments of this sort are common on inland waters as well as by rail.

It appears, then, that the methods of transportation employed by establishments operating under Government inspection approach about as near to the ideal as practical conditions permit. But to the interested consumer the matter is not yet ended. He may be glad to know that his roast beef has come thus far in prime condition, but it is still some distance away from his own kitchen. From this point on he must look to his State or municipal authorities to safeguard him. Under our American principle of State's rights, the scope of operation of the meat-inspection act is limited to establishments the products of which, in whole or in part, enter into interstate or foreign commerce. Obviously, then, it does not cover the operations of any slaughterers, packers, wholesale or retail dealers, who ship or sell their products entirely and only within the boundaries of the State in which they were slaughtered or prepared, and when meat bearing the inspection stamp comes into the hands of such an establishment, the responsibility and authority of the Federal Government is ended. However, what may happen to the meat after delivery by the inspected establishment is primarily a matter of storage, and does not concern us now. As far as the last stage of transportation is concerned, the retail purchaser in a city may rightfully demand that his meat should be brought to his house in a covered wagon; that it should be securely wrapped in clean, dry, nonabsorbent paper, free from foreign odors; and that the inner wrapping of paper next the meat should feel distinctly cold to the touch.

At the present time, of the animals covered by the meat-inspection act, namely, cattle, sheep, swine, and goats, only about 60 per cent of those slaughtered are handled in establishments having regular and continuous inspection by the Federal Government and enter commerce bearing the official inspection marks. The balance, together with vast quantities of other animal food products, such as butter, cheese, milk, poultry, and eggs, may or may not be prepared and transported with a fair measure of regard for hygienic requirements. We should gain little by citing concrete examples of bad practice; it is sufficient that they exist and call for remedy.

In considering how methods of transportation may be improved, it is necessary, first of all, to recognize that any transportation whatever of any food product whatever is, in itself, objectionable. Admit that milk freshly drawn from the cow is preferable to that transported from a distance even under the best hygienic conditions. Shall we then have cows driven to our front yards and milked there? Transportation of some kind is unavoidable. If we do not transport dressed beef, we must transport the live animal, and it is simply a matter of balance between two sets of undesirable conditions. The ends to be attained are wholesome products at reasonable prices, produced with the minimum of sanitary offense and danger to the country at large. Whether the ends may be best attained by the transportation of live cattle over long distances, or the transportation of dressed meats over long distances, must be worked out for each individual set of circumstances. Under present conditions, shipment of dressed meat seems generally preferable to shipment of live animals.

At any given period of time it is necessary to work for practicable ends and to advance by single steps. We have now succeeded in this country in putting products prepared in Government-inspected establishments upon a gratifying hygienic level. The Bureau of Animal Industry stands ready to assert that, all things considered, its inspection service is as strict and efficient as any in the world to-day. It has become what it is, first, because the people of the country demanded it; second, they provided the necessary funds and power to act; and, third, they have allowed those in charge to fearlessly work out their problems on a triple basis of scientific training, practical experience, and good judgment.

The same procedure must be followed through in case of all other products. The first step is the education of the consumer, crystallizing into an intelligent public sentiment; the second, the education of the manufacturer. Much may be accomplished by these means alone, and the Department of Agriculture, through its various bureaus, has pushed campaigns on all the above-mentioned products by the publication of many bulletins containing results of careful study of the various problems involved. A heavy demand for these bulletins and much actual improvement in conditions is evidence of the value of the work. But this alone is not enough. Even the intelligent consumer often has no means of knowing whether any particular article, such as a quart of milk, is or is not potentially dangerous to health. Even an intelligent and conscientious manufacturer or producer is discouraged when he realizes that all the expense and trouble to which he may go may either be vitiated by careless handling of his products after they leave his personal control or be totally unappreciated by consumers who rebel against his neces-

sarily higher prices. And none of this touches the unintelligent and indifferent—unfortunately, a considerable bulk of the population. The only agency, therefore, through which the hygienic character of all animal food products can be assured is an adequate inspection service—it matters little whether it be Federal, State, or municipal—for all three forms must cooperate and supplement one another. For this, then, the manufacturer and consumer both must work. It is the only sure safeguard to the health of the one and the only protection to the other from unscrupulous and indifferent competitors and dealers. In this connection transportation can not stand in a class by itself. It is only one phase, and often a very minor phase, of the whole industry of the preparation and handling of animal food products.

THE ECONOMIC PROBLEMS OF MILK DISTRIBUTION IN THEIR RELATION TO THE PUBLIC HEALTH.

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One of the most complex problems with which municipalities now have to contend is that which has to do with securing for its citizens a supply of wholesome milk. Its difficulties may be measured somewhat by the fact that in spite of 15 or 20 years' study and effort it is still unsolved. There has been no improvement in the Rochester milk supply in 12 years, although during that time the city has been almost constantly a center of agitation for pure milk. To a greater or lesser extent the same may be said of many other American cities.

In attempting its solution municipalities and public health workers have very generally regarded it as purely a sanitary problem, and from that standpoint alone it has been attacked. Vital as is this basis, it is quite conceivable that there may be other salient factors which are largely overlooked. For example, if it were assumed that to comply with stringent health ordinances relating to the production and distribution of milk would mean financial disaster to those engaged in the work the problem would then have an economic basis which, to the dealer and producer at least, would transcend in importance the sanitary phase of the question. For obviously men will not make and sell pure milk if it can not be done profitably. And if the imposition of law and ordinance tending to safeguard public milk supplies operates to lessen or destroy the financial reward of those engaged in the industry it is inevitable that either the business must fail or the law be evaded. It should be remembered that the milk industry, in spite of the public character given to it by city and State supervision, is amenable to the same laws of business as is any

industry which deals in commodities. It is quite probable, therefore, that the problem has an economic basis of much greater significance than is generally believed. With these ideas in mind, an economic study of the Rochester milk situation was begun. Investigations inquiring into the production, distribution, and consumption of milk were undertaken. In this paper the subject of production will not be considered.

In order to get some definite knowledge of the use of milk in homes, a very extensive inquiry into this subject was made. Fifteen sections of the city, each containing from 100 to 700 homes, were studied. In all over 5,000, or about one-tenth, of the homes in the city were visited. Each section differs more or less from the others in wealth, social standing, or nationality. Effort was made to learn the number of people in the home, the number of children under 5 years of age, the amount and kind of milk used, and the name of the distributor. In Table No. 1, wherein are classified this data, it will be noted that the proportion of children under 5 years is greater, as would be expected, among the poor than it is among the well to do. The poorer classes use less milk and accordingly buy it in smaller quantities. It was also noted that the use of store milk and condensed milk is largely confined to the laboring classes. The explanation of this lies in the fact that less than half of these people have refrigerators or take ice and, therefore, have little means of preserving perishable foods.

The most interesting information in this table is the large number of milkmen going into each district. For example, in the fourth section there are 27 distributors supplying 273 homes. These 27 dealers travel more than 25 miles in this district, whereas 1 dealer could render the same service traveling not more than 2.6 miles. In section 8 there are 57 distributors traveling more than 30 miles daily in the section to supply 363 homes with milk. One distributer could render this same service in a travel of 1.7 miles. On many streets there is a milk dealer for every 2 homes, oftentimes several different dealers will be found going to one home. In one case 9 peddlers were found supplying 1 pint each to 1 home.

This waste of time, energy, and equipment is very much greater than is generally believed. At the present time half of what the consumer pays for milk is required to maintain this wasteful system of distribution. The farmer receives per quart for his milk no more for owning and operating a dairy farm, preparing the milk for market, and transporting it many miles into the city than does the distributor who merely receives it at the railroad, bottles it, and delivers it to the consumer. This is obviously a very unfair division of revenue. Aside from its economic phase there are other well-grounded objections to this excessive traffic in the street noise, dirt, and nuisance

occasioned by the rattling and banging of unnecessary milk wagons on city streets.

There were in Rochester at the time this investigation was begun about 185 milk dealers. The number varies from time to time because new individuals are frequently engaging in the business and the established routes are continually changing hands. During a period of two years, while this research was under way, there were upward of 50 such changes. In a few instances information was refused; in most, however, the milk dealers willingly assisted in the inquiry. Data were secured from 173 distributors; the remaining few were small dealers whose business operations would inappreciably affect the data as compiled in this study. Very few of the milk dealers keep any records other than an account of what is owing to them and of their own indebtedness. With half a dozen exceptions, among the larger dealers, none of them have an accounting system which would make it possible to determine accurately the cost of the various factors entering into the problem of distribution. Accordingly, in many instances, where no record was available, approximate costs were arrived at after a most diligent inquiry into the business and consultation with experts and others who are in the best position to render an opinion.

This is well illustrated in the case of coal and ice. Very few of the milk dealers of Rochester have a power plant or a steam boiler. Many of them heat on the kitchen stove the water which is used for washing bottles and cans. Obviously no definite judgment can be formed as to the amount of coal which is used for this purpose. In the matter of ice similar difficulties obtain. The amount used and the price paid for it is extremely variable. In these instances where data were lacking the amount set down represents a very conservative estimate, based on the records of responsible dealers.

For the purpose of study the distributors are divided into 4 groups according to the business they do. The first group is composed of 25 dealers who sell not more than 150 quarts daily. The second group consists of 101 distributors who sell from 151 to 300 quarts. The third is made up of 44 dealers who distribute from 301 to 1,000 quarts. In the fourth group are the 3 large milk companies of the city, who dispense from 3,000 to 8,000 quarts each. The first 3 groups may be classed as small dealers. Many of them are men who have worked unsuccessfully at other occupations and have gone into the milk business as an easy way of earning a living. Occasionally one is to be found who works at a trade and takes care of the milk work outside of the hours of his regular employment. Many of them begin business by buying an old worn-out horse and a second-hand wagon, which are often paid for on the installment plan. The usual type of milk wagon is a small four-wheel vehicle, with or

without top, divided in the center by a seat and an opening for the driver to get in and out, and with the carrying capacity of between 100 and 200 quarts.

It is difficult to determine the length of routes of these small dealers, for very few of them have any idea how far they travel. Most of them peddle from 4 to 8 hours a day and longer, at a rate probably not slower than 2 miles per hour, or from 8 to 20 miles per day. In one instance, it was learned that a dealer drove 3 miles daily to deliver 1 pint of milk. The number of customers supplied by these small dealers varies from 75 to 300. The milk room of most of the dealers in the first 3 groups is usually in one end of the horse barn or in a small wing attached either to the stable or dwelling. In most cases it consists merely of a small room with a cement floor provided with a drain. Most of them contain large watertight wooden or concrete boxes in which the milk is kept. So flimsy is the character of many of these buildings that fire insurance companies will not permit steam boilers; accordingly, only a few of the larger dealers have them. Most of the dealers have no other facility than a small stove for the purpose of furnishing hot water for cleaning, and some have not even this convenience. After the cans are washed it is a custom to set them out in the yard or street to air. The sanitary significance of this practice is seen in the bacterial examination of the milk.

A great deal of the milk sold in the poorer sections is dipped from cans. The frequent opening of the containers on the dusty street and the pouring back and forth of the milk give ample opportunity for contamination. Practically all of the small dealers use some bottles, the cost of which, to them, is extremely problematical. From an examination of the bottle expense of many dealers it is estimated that the average milk bottle makes about 12 to 15 trips to the consumer, when it is either lost, stolen, or broken. The small dealers, particularly, are guilty of appropriating the bottles of their larger competitors. On casually glancing over the crates of one reputable dealer, the bottles of 14 other distributors were found. In another case the bottles of 17 concerns were noted in only two crates containing 24 bottles. This distributer volunteered the information that the most of his customers had more than one milkman and that it was the custom for the first one on the ground to take the bottles of the others. This practice of using the bottles of other dealers is by no means confined to a few small irresponsible concerns, but, on the contrary, is quite general. Out of this custom has developed, among dealers and their employees, a spirit of carelessness in the handling of bottles, and thousands of them are broken and thrown away yearly. In the yards of most milkmen will be seen barrels of broken milk bottles, representing many dollars loss. On the

premises of one dealer, who sells less than 150 quarts daily, were found five large barrels, each full of broken glass, representing at least 1,000 milk bottles, most of them belonging to other distributors. These had been collecting over a period of one and one-half years. They cost their original purchasers at least $55.

Milk dealers, however, are not the only ones who are guilty of this wastefulness, for to housekeepers must be charged a large part of this needless loss. Every year thousands of milk bottles are used in homes and shops for the storing of food and for other purposes. Thousands of them are thrown into ash and rubbish cans and are thus broken or lost. Recently the city has established a plant for the sorting of rubbish and the saving of such portions as are valuable. During the past six months 3,000 good milk bottles were thus rescued, but at least as many more were broken and destroyed. A milk bottle costs 3½ to 6½ cents, depending on the size and quantity purchased. The average price paid for a quart milk bottle is 5½ cents. With these figures in mind, it will be readily appreciated that the yearly bottle loss from theft and carelessness is very great. In Rochester this amounts to about $10,000 a year. This is a tax which contributes not a little to the cost of milk and is one which the consumer, of course, must bear.

An examination of the accounting of the various groups of dealers, as exhibited in Table No. 2, shows conclusively that most of the distributors make only a very meager living. In many cases the income is much less than that of laborers and unskilled mechanics. This fact, taken in conjunction with the fluctuations in trade and losses which commonly occur, makes the business a most precarious one. For these reasons the less responsible dealers are tempted to recoup their losses by resorting to various practices, most common of which is stealing the bottles and adulterating and selling of old milk. It is hard to see how any form of judicial regulation or legislation will correct these evils, because of the inherent difficulties in compelling men to obey laws which will deprive them of a living.

In order to determine the facility with which milk can be delivered under conditions most favorable for economy and efficiency the following experiment was undertaken. It was assumed that milk could be delivered more expeditiously if one truck and crew of men were to supply one section and that the greatest economy of time and energy could be secured by having a man on each side of the street carrying milk from the truck into the house and one man whose duties would consist of driving the truck and of assisting the carriers.

It was first intended to test the efficiency and economy of various types of motor and horse-drawn vehicles, but this idea was abandoned for reasons to be mentioned later. In the tests that were made

an electric vehicle, with carrying capacity of 1,000 pounds, courteously furnished by the Empire State Electric Vehicle Co., was used.

In place of milk several pigs of lead, the weight of which equaled that of a load of milk was carried. Besides the driver there were two clerks, supplied with the necessary apparatus for accurately measuring distance and time, who made observations and recorded the data. There were two men who carried fictitious bottles of milk from the truck into the homes. Each had a steel basket, similar to that used by milkmen, in which was placed three quart and two pint milk bottles filled with water. This load would correspond to the average weight in milk necessary to supply two homes. Besides the foregoing, each had literature relating to the pure-milk movement, which was deposited in the milk box in place of milk, and notations were made as to milk boxes and other conveniences pertaining to the receiving of milk. These efforts would equal the labor performed by the present peddlers.

Each stop made by the truck was timed with a stop watch and recorded. The distance traveled by the truck was also measured by an odometer and confirmed by map measurements. The time required by each carrier to go from the truck to the milk boxes or side doors of each two houses and deposit therein the circulars above mentioned, to make notes as to the milk boxes, and to return to the truck was measured and recorded upward of 200 times.

The carriers were instructed and frequently cautioned not to travel faster than would be done in business practice. Previous to beginning this experiment, a number of ordinary milkmen were timed, without their knowledge. It was observed that these men ordinarily occupy from 12 to 40 seconds in going from the wagon in to the house and returning again to the wagon. The average of a large number of observations in a section where milk boxes are common is about 25 seconds. The mail carrier in the same section makes about 100 stops an hour, although he is delayed by being obliged to wait until the door is opened and the mail received. With these controls as corroborative evidence, it is believed that milk, under practical conditions, could be delivered with the same speed and facility as was theoretically done in this test.

The experiment was begun and continued for two hours in the well-to-do district, known in this study as the Barrington Street section. It was then repeated under similar conditions in one of the crowded sections of the city occupied by the poorer or laboring class of people. This is designated as the Baden Street section.

On examination of Table No. 3, it will be seen that in each district the electric truck was standing still nearly two-thirds of the time. The main advantage to be gained in the use of a motor-propelled

vehicle over a horse-drawn truck is that it is able to travel faster and over longer distances. It will be seen at once that in house-to-house distribution of milk, such an advantage would not exist, because it is not possible to deliver milk rapidly enough to keep a truck in constant motion. It may therefore be concluded that for short-haul delivery there is no economy in the use of the electric truck over the horse-drawn vehicle on the basis of work. The time which the truck is standing still, however, could be very advantageously used by the driver in loading the baskets for the carriers and in keeping record of the sales, thus markedly facilitating delivery.

In the Barrington Street section it will be noted that a large proportion of the houses have milk boxes, while in the poorer Baden Street section very few homes afford this convenience. The milk box has greater hygienic and economic significance than is generally believed. It serves to protect the milk from the sun, from insects, and domestic animals. Milk can be delivered much more rapidly to homes having milk boxes than it can to houses without this receptacle, particularly where it is necessary for the peddler to knock at the door and await the coming of the housekeeper. Observations on this point were made in the Baden Street section, and it was noted that from one to three minutes was consumed by the dealer in delivering the milk. On this point it may be mentioned that the sale of milk in bottles greatly facilitates delivery. Can milk is sold quite extensively in the poorer sections of Rochester.

In the Barrington Street section it will be noted that the truck traveled 2.4 miles. From data acquired in a previous study it was learned that the present milkmen supplying this territory drive 38 miles in going to and fro on these streets, a very great waste of time and energy. In the Baden Street section the experimental truck traveled 1.7 miles, whereas the present distributors now traverse more than 30 miles to do the same work. These comparative figures strikingly illustrate the great waste of energy and time now involved in the distribution of milk.

In the Barrington Street section, where the families use an average of 3 quarts each, it is estimated that about 1,077 quarts of milk could have been distributed in two hours, while in the Baden Street section, where the average amount used daily is 1.3 quarts, there could be delivered in two hours approximately 785 quarts.

These figures represent the work of men physically untrained for active work. It is highly probable that in practical operation, where employees paid by piecework, or in proportion to the amount they distributed, these estimates could easily be exceeded. In this investigation, for the purpose of comparison, it is conservatively assumed that an average of 400 quarts could be distributed per hour during

an eight-hour day, or that one truck drawn by two horses and manned by three men could dispense an average of 3,200 quarts of milk in one working day.

The economic significance of the present method of distribution, as exhibited in the data compiled in Table No. 2, merits a brief analysis and comment. It will be noted that there are 25 distributors selling not more than 150 quarts daily. These distributors require the services of 29 men, 34 horses, and 26 wagons. They travel 199 miles to supply 3,016 quarts of milk to 2,270 homes. There is invested in 23 insanitary, poorly equipped milk rooms, $3,300; in inferior horses and wagons, $8,815. The wage and labor profit received by these 29 men is approximately $33.63 daily, an average of $1.16 per day per man.

If this service were concentrated in one section under a single efficient distributing agency, thus avoiding the overlapping of routes, the waste of labor and the reduplication of equipment, it could be rendered in a superior manner by a much smaller force and equipment, as is indicated in the following table:

Under present system.		*Under model system.*	
29 men at $1.16 per day	$33.63	3 men at $2.50 per day	$7.50
34 horses and 26 wagons, maintenance	26.00	4 horses, daily maintenance	5.00
		1 truck, maintenance	.25
		1 motor truck, part of day	2.00
		Superintendence	6.00
Total	59.63	Total	20.75

The $3,300 now invested in the 23 small insanitary milk rooms would furnish a very good equipment for one sanitary depot. A complete outfit of horses and trucks could be had for $1,100, a saving of at least $7,700. The economies that could be effected by correcting these and other unnecessary wastes on this amount of service would lessen the cost of distribution about $40 per day, or 1.5 cents per quart.

In the next group it will be seen that there are 101 distributors, requiring the services of 133 men, and, in many instances, the wives and children; 160 horses and 137 wagons. These travel over 1,050 miles to supply 21,000 quarts of milk to 13,900 homes. There is invested, in 101 insanitary milk-room equipments, approximately $17,900; in horses and wagons, about $45,000. These men, for owning and operating the business, receive a labor profit of about $340 daily, from which must be deducted rent, losses from bad debts, and accidents.

If this service were concentrated in one section of the city, under a single efficient agency, it could be rendered much more economically, as is indicated in the following tabulation:

Under present system.		*Under model system.*	
133 men receiving wage and labor profit	$397	31 men, at $2.50 per day	$78
160 horses and 137 wagons, daily maintenance	150	18 horses	22
		8 trucks	2
		1 motor truck	8
		Superintendence	25
Total	549	Total	145

The $17,900 would equip one model sanitary plant. At least $35,000 could be saved in investment on horses and trucks. These economies and others which could be effected would lessen the cost of distribution on this amount of service approximately $400 per day, reducing the cost of milk 1.7 cents per quart.

In the third group there are 44 distributors, requiring the services of 99 men, 101 horses, and 92 wagons. They travel over 600 miles to supply 20,500 quarts of milk to 15,400 homes. There is invested in crude milk-room equipments $16,750, in horses and wagons about $29,800. These men for owning and operating the business receive a labor profit of approximately $330, out of which must be paid rent, taxes, losses from bad debts, and accidents.

If this service were concentrated in one section of the city under a single efficient agency it could be rendered much more economically, as is indicated in the following comparative table:

Under present system.		*Under model system.*	
99 men receiving wage and labor profit	$407	31 men at $2.50 per day	$78
101 horses and 92 wagons, daily maintenance	101	18 horses, maintenance	22
		7 trucks, maintenance	2
		1 motor truck	8
		Superintendence	25
Total	507	Total	135

The $16,750 would properly equip one sanitary milk depot. A complete equipment of horses and trucks could be purchased for $9,000, saving in investment at least $20,000. These economies would reduce the cost of distribution at least $375 per day, lessening the cost of milk about 1.7 cents per quart.

The fourth group is composed of 3 large milk companies of the city, whose aggregate business, when compared with the milk companies of some other cities, is very small. These 3 companies now employ 95 men, 65 horses, and 50 wagons, traveling 641 miles to supply 15,000 quarts milk to 9,800 homes. They have invested in real estate and buildings $96,700, in milk-room equipment $38,450, in

horses and wagons $25,035. Their combined labor profit varies between $78 and $100 daily.

By proper adjustments of routes, this service could be rendered by any one of the companies in their present plants and employing a smaller force, as is indicated in the following tabulation:

Under present system.		*Under model system.*	
95 men receiving wage and labor profit	$271	20 men at $2.50 per day	$50
65 horses and 50 wagons, daily maintenance	100	12 horses, maintenance	15
		4 trucks	2
		1 motor truck	8
		Superintendence	25
Total	371	Total	100

At least $100,000 could be saved in unnecessary investment in real estate, milk-room equipment, and horses and wagons. The economies resulting from this combination and concentration would reduce the cost of distribution at least $300 daily.

In all, 173 distributors were studied. These represent practically the entire milk industry of the city. The enormous waste and the saving that could be effected by proper distribution incident to the distribution of milk is more clearly set forth in the following comparative tabulation:

Under present system.	*Under model system.*
356 men, and in many cases their families.	90 men.
380 horses.	50 horses.
305 wagons.	25 horse-drawn trucks.
2,509+ miles travel.	300 miles travel.
$76,600 invested in milk-room equipments.	$75,000 equipment for sanitary plant.
$108,000 invested in horses and wagons.	$30,750 equipment of horses and trucks.
$2,000 present daily cost of distribution.	$600 estimated daily cost of distribution.
$720,000 yearly cost of distribution.	$220,000 estimated yearly cost of distribution.

In the foregoing estimates, liberal provision is made for amortization, interest, and superintendence. Mention is not made of all the wastes that could be obviated under efficient management, and it is believed that conclusions here presented represent most conservative judgment. There is little question that if the milk supply of Rochester were to be distributed by one agency, properly organized and equipped, a saving to consumers of at least $500,000 yearly could be effected.

The results of this study clearly indicate that the present system of milk distribution, such as is found in Rochester and most American cities, is very wasteful and is responsible for much of the bad milk that is sold. At the present time municipalities are attempting

to protect the public milk supplies by exercising their police power in endeavoring to maintain certain standards of purity. With the exception of a few large cities the milk business is in the hands of many small dealers, who have no training or fitness for the occupation. While the prevailing system of espionage of health bureaus occasionally detects and represses vendors of impure milk, the system utterly fails to secure an unvarying dependable supply. One inevitable conclusion from this study is that this extravagant method of distribution not only adds an unnecessary burden on the consumer but it also reacts on the distributor, because it makes the business too unprofitable to be done well. It is to be doubted, therefore, if any great headway will be made in the municipal milk problem by legal mandate under the present conditions.

So universal is the use of milk that it may be regarded as a necessity of life. Its purity, therefore, has an important bearing on the public health. In this respect it may be compared to water. Municipalities have long since appreciated the necessity of preserving the integrity of their water supplies even to the extent of owning them. It likewise recognizes the expedience of providing a market place where the sale and exchange of less perishable foods may be facilitated in an economical and cleanly manner. For similar reasons it undertakes to either regulate, control, or operate many industries which have to do with the public welfare. The city of Rochester owns its waterworks, collects its own ashes, operates an incinerating plant for the sorting and disposal of rubbish, and controls the collection of its garbage. All of these activities bear an important relation to the public health, but none the less does milk. Why, therefore, should not cities control their own milk supplies, to the end that the people may have pure, wholesome milk at the same minimum cost?

TABLE No. 1.—*Showing the use of milk in homes and the excessive and unnecessary traffic by the present distributors.*

Section.	Class.	Number of homes.	Number of people.	Children under 5 years.	Amount milk used daily (quarts).	Families using daily—						Families using—				Number of homes supplied by distributors.	Number of distributors in section.	Miles one distributor would travel in supplying section.	Miles present distributor travels in supplying section.
						½ quart.	1 quart.	1½ quarts.	2 quarts.	2½ quarts.	3 quarts.	Certified milk.	Condensed milk.		Store milk.				
													Exclusively.	Partly.					
1	Chiefly colored	231	1,128	67	245	51	122	10	24	.....	11	6	11	4	48	165	23	2	20
2	American laboring	523	2,308	159	532	131	242	21	67	50	18	.....	23	30	70	432	55	3	45
3	.....do	462	2,067	143	475	135	204	28	53	1	16	2	21	37	103	340	40	3	30
4	Well-to-do	283	1,176	67	398	35	132	27	61	1	26	14	1	10	4	273	27	2.6	24
5	German-American laboring	527	2,647	224	626	117	231	41	80	36	39	2	8	6	28	508	39	4.4	61
6	Well-to-do	115	518	19	169	12	57	9	24	1	11	5	.....	.....	.....	120	14	1.2	12
7	Italian laboring	643	3,172	538	388	218	143	26	26	1	8	18	52	25	29	353	51	3	36
8	Jewish laboring	477	2,316	310	623	65	170	63	103	4	26	11	16	32	28	363	57	1.7	30
9	German laboring	234	1,245	94	289	37	90	33	39	1	16	.....	10	.....	5	145	39	1.7	20
10	American middle	450	1,939	112	523	92	217	39	66	.....	21	8	4	.....	13	443	26	2.4	48
11	Well-to-do	201	891	24	352	17	63	12	66	.....	32	18	.....	.....	1	166	25	2.5	21
12	.....do	99	495	20	190	5	24	8	24	.....	25	4	.....	.....	1	91	17	2	14
13	.....do	209	845	41	303	23	88	9	56	.....	20	29	.....	.....	.....	216	34	2.5	38
14	American laboring	191	851	57	165	72	59	12	19	.....	5	.....	18	11	10	167	31	1.7	21
15	.....do	786	.....	200	1,100	192	258	44	38	36	.....	2	39	.....	62	786	62	5.4	57

TABLE No. 2.—*Showing the total accounting of milk distributors in Rochester, grouped according to the volume of business done.*

Schedules.	Distributors selling daily—				Total.
	Not more than 150 quarts.	From 151 to 300 quarts.	From 301 to 1,000 quarts.	1,000 quarts or more.	
Distributors.....number..	25	101	44	3	173
Milk, retail.....quarts..	2,887	21,368	17,180	8,900	50,335
Milk, wholesale.....do....	129	2,411	3,415	6,000	11,947
Total milk sold.....do....	3,016	23,799	20,599	14,900	62,314
Men employed.....number..	29	133	99	95	356
Horses employed.....do....	34	160	101	65	360
Wagons employed.....do....	26	137	92	50	305
Length of route.....miles..	199	1,053	616	641	2,509
Customers.....number..	1,885	13,915	9,490	9,800	35,090
Value milk-room equipment.....	$2,407	$17,295	$16,750	$38,450	$76,902
Value horses and wagons.....	8,815	45,105	28,495	25,035	107,450
Value real estate.....	.....	.....	.....	96,700	96,700
Total investment.....	11,222	62,400	44,245	160,185	278,052
Interest, depreciation on investment.....	$6.17	$34.17	$25.16	$45.15	$110.65
Cost of coal and ice.....	8.92	42.25	39.03	17.20	107.40
Milk shrinkage, waste, etc.....	4.35	36.59	28.55	14.55	84.04
Maintenance horse and wagon.....	25.30	152.50	101.00	100.00	378.80
Daily wages, labor.....	5.60	48.95	74.20	193.06	321.81
Cost of bottles.....	7.38	77.36	74.89	21.00	180.63
Total cost distribution.....	57.72	392.82	342.83	390.98	1,184.35
Amount paid producer.....	128.71	999.55	880.44	886.40	2,895.10
Total cost to distributor.....	186.43	1,392.37	1,223.27	1,277.38	4,079.45
Milk receipts, retail.....	213.31	1,535.05	1,254.67	682.00	3,685.03
Milk receipts, wholesale.....	1.00	138.26	195.87	314.50	548.63
Cream receipts.....	6.75	60.84	106.20	67.51	241.50
Total receipts.....	220.06	1,734.15	1,556.74	1,366.01	4,876.96
Labor profit.....	37.59	341.78	333.47	78.58	791.42
Labor loss.....	3.96	.....	.....	.....	.....

TABLE No. 3.—*Experiment in milk distribution.*

	Streets.	
	Baden, Catherine, Vienna, Morris, etc.	Barrington, Dartmouth, Westminster Road, Rutgers.
Families living in single houses.....number..	248	248
Families living in double houses.....do....	202	52
Families living in apartments.....do....	154	23
Total families visited in section.....do....	604	359
Houses having milk boxes.....do....	11	297
Houses having no milk boxes.....do....	593	52
Average amount milk used daily in homes.....quarts..	1.3	3
Total amount milk used daily in section.....do....	785	1,077
Total length streets in section.....miles..	1.6	2.5
Distance traveled by truck in section.....do....	1.7	2.4
Distance traveled by present peddlers in supplying section.....do....	30	38
Stops made by truck.....number..	78	67
Average time required to go from truck to each two houses, leave milk, and return to truck.....	*H. m. s.* 46	*H. m. s.* 62
Total time of experiment.....	2 0 0	2 0 0
Total time truck was in motion.....	34 45	40 2
Total time truck was standing still.....	1 25 15	1 19 15

THURSDAY MORNING, SEPTEMBER 26, 1912.

PREVENTION OF ACCIDENTS: EXAMINATION, EDUCATION, AND CARE OF EMPLOYEES OF COMMON CARRIERS.

Hon. J. D. M. HAMILTON, Claims Attorney, the Atchison, Topeka & Santa Fe Railway System, Topeka, Kans.

It is with pleasure that I am privileged to take part in the discussion of a question that is becoming national, not only with our own Government, but every civilized nation in the world; that is, betterment of the conditions surrounding the laborer in the performance of his daily task as to safety to himself and his fellows or to those whom he serves or with whom he comes in contact. Railway corporations are to-day afflicted with laws, prominent among which are the employers' liability and workmen's compensation acts, which were enacted for the purpose of requiring the corporations to exercise care in the selection of employees, maintenance of track, equipment, and operation of trains.

It will be my purpose, in the brief time allotted, to say a few words on the examination, education, and care of employees, as my experience for a number of years has brought me in contact with those particularly who are in the employ of railway corporations, and these subjects cover only a brief outline of safety principles. I am a strong advocate of the protection of the American laborer—his advancement and education, not only as to improving his competency in his trade, but that the Government may have in him and his allegiance a better citizen and one upon whom it can depend for its preservation and maintenance. I have always contended that the management of our railways, in the operating and mechanical departments, are too far away from the employees. They have never been brought close together. The only way this can be remedied is by building up a strong, powerful organization among the employees, who should be consulted upon all questions of safety.

The great catastrophies happening upon our railroads indicate carelessness, and the resulting loss of life, injuries to persons, and damage to property might just as well be avoided. You can look over the calendar of the Interstate Commerce Commission and in studying it you will find that 65 or 70 per cent of accidents reported to that body by railway authorities occur through the carelessness

of the men themselves or those working with them. This being a fact, it is incumbent upon the operating as well as the mechanical department that every railway should see that competent men are employed to do the work. This can be accomplished, first, by the examination as to physical fitness of men who are to operate trains or propel machinery or do other work of these great transportation enterprises. There is no branch of industry where labor is employed which calls for greater exercise of care or where the public ought to exact so thorough a competency as that of the railway laborer. The operation of the vast mileage of the railway systems of this land calls into service 2,000,000 of the bone and sinew of industrial labor for the rapid handling of mail, express, passengers, and freight. There is none so closely allied to the Government and public as the railway employee, and as such he must possess knowledge and efficiency in the work to which he may be assigned. It is therefore important to the employee and to the public that the men employed shall be strong mentally and physically.

It is not my purpose to here present numerous tables of statistics, but it can be conservatively estimated that 25 per cent of all the railway employees of our Government are in engine, train, and switch service, and it is necessary to subject them to rigid physical examination, not only before entering the service, but at stated intervals during the time they are so employed. Safety in the carriage of passengers or of freight depends upon careful train service. Humanity is bound to make mistakes, but a mistake ought not to cause an accident, where the error could have been discovered and corrected beforehand. Every railroad inspects its roadbed, ties, equipment, and machinery before it is placed in use to determine the fitness of such material, and its subsequent condition is regularly looked after by a corps of inspectors with a view not only to the safety of the public and the employees, but to the preservation of the property of the company. What precaution is necessary as to the inspection and the testing of the fitness of the men? It is true that such men are physically examined before entering the service, but what is the character of the examination? I fear that it is in many instances superficial, not based upon the exacting requirements of the employment.

We are told that soldiers and sailors are submitted to a thorough examination as to their physical fitness. If such care is demanded by the Government for the protection of its citizens and their property, why should not our railways pursue the same course, thereby securing a higher grade of men for such employment? We fail to find, however, wherein any legislative body has sought to enact any law to examine, educate, and improve the competency of railway employees. There are many laws upon the statute books concerning the requirement of railways in the matter of the betterment of the

roadbed, equipment, appliances, inspection of boilers, and so on, all controlled and protected by legal enactments, and I confess that much improvement has come from the passage of such laws. Why should not equal care be exercised in the examination of railway employees? Our Government has promulgated maritime laws, emphasizing the necessity of an examination and license of the crews that ply the high seas, lakes, and inland navigable streams for the purpose of safeguarding not only those engaged in such pursuits, but the cargo, be it human or freight. The Government compels these men to go before an examining board and pass an examination, and, if competent, a license is issued; and this means that they are qualified to discharge the duty which they are expected to render to the company and to the public. I predict that it will not be many years before every man in charge of a throttle of an engine, or one who puts fuel into the fire box, as well as conductors and brakemen, will be licensed, and will secure such license from the railway company through a board of examiners of competent employers before they are allowed to take a train out of the station. When such precautionary acts are brought into service, then we will find strong, healthy men, with excellent characters, handling the trains of our country. Such legislation of our Government, requiring railway companies so to do, will be as advantageous as the vaintenance of universities for the education of the Indian and the Negro. When this form of classified physical examination is adopted an improvement can be wrought, not only on railways, but in every enterprise where labor is employed.

On a few of the great railway systems physical examinations have never been enforced, even in elementary form, but the time has come when the power of the press, as well as the demands of a restless people for greater safety, will not longer be denied. I suggest such physical examination can be had in such classification as the following:

1. Visual power.
2. Its cognate, color perception.
3. Aural sense, or the faculty of hearing.
4. Hernia, and other physical defects.
5. Mental qualifications, evidenced by education and natural fitness.
6. Moral fitness, attested by high standards.

The advantages of a thorough physical examination of employees can be briefly summarized in the words of one who has had considerable experience in the examination of railway employees:

It will close the avenue to the employment of men, physically or otherwise unfit, by subordinate officers sometimes prone to permit personal friendship or fraternal bonds to become stepping stones to employment.

It will interpose an effective shield against personal and political favoritism to employ inefficient men.

It will, properly administered, eliminate a sentimentality inconsistent with conscientious examination.

It will deny employment to vicious men, and divorce from the service men whose evil influences tend to lower ideals.

It will mark an improvement in the personnel, elevate the physical and intellectual standards, and result in a moral uplift inevitably reflected in reduced cost of operation.

It will give assurance of better service upon the part of the employees.

It will reduce the number of accidents, and thus conserve human life and property.

It will deter men of low physical, mental, or moral standard from applying for employment, confronted with the certainty of rejection.

It will give to the public assurance of greater safety, and thus stimulate travel.

There is nothing so conducive to the safety of employees as their education and competency. In the rush to relieve crowded conditions of traffic some laborers of mediocre ability are sure to break into the ranks, and thereby increase the hazard in the operation of trains, which depends upon a code of signals, a knowledge and obedience of rules, and of time cards. So far as the Harriman lines are concerned no better protection could be attained by educational means than is furnished by the school of instruction for novices in the different branches of railway operation, in the operating and mechanical departments, prior to entering the service. Evidence of knowledge and efficiency is furnished by a diploma, whether the candidate enters the train, engine, yard, or shop department. This preliminary instruction is thoroughly practical, is a valuable aid to the proficiency of the student, and to his advancement in his trade. The employer has certainly done his duty in furnishing the employee with appliances that are reasonably safe, a suitable place in which to work, and, so far as is possible, competent subordinates. When this has been done, it is up to the employee to show his capability.

The campaign for the education of employees was inaugurated by the United States Steel Co., and was first put into practical use on railways by the Chicago & North Western Railway Co., through the efforts of Mr. R. C. Richards, general claim agent, and the result was so satisfactory that we now see similar safety organizations on almost every railway line in the country. There is no instrument so potent in promoting the safety habit as the education of the employee. It will smother ignorance, eradicate incompetency, eliminate the chance taker, and drive the careless out of the service.

The hand laborer has in a large measure been superseded by machinery, but this transformation has necessitated the education of men to operate machinery, and here, it can be said, is the commencement of the education of the laborer; and, with his competency thus improved and specialized, we must expect to develop a higher and better grade of ordinary workmen, as well as of workingmen

who, by years of experience, will become able to command higher wages; and with all this we may expect a higher sense of responsibility for the safety of workmen and machinery.

If the employee is educated in the proper handling of machinery, in obedience to rules and regulations, and in the exercise of care toward himself and fellows, then the prevention of accidents will in a large measure be accomplished. Every employee ought to be educated in and thoroughly inoculated with habits of safety.

In the care of employees, a duty devolves upon the employer. He must give the laborer suitable material and tools, a safe place to work, and careful employees with whom to work; and, as a reciprocal duty, the employee must possess sufficient knowledge to do the labor for which he is hired and must exercise care in the performance thereof. Many laws have been passed to guard the laborer. In addition to all these, the employers are surrounding the laborers with many provisions for their health, happiness, and culture. Hospitals, reading rooms, Young Men's Christian Associations, pension, voluntary relief, educational bureaus, and schools of instruction—all must necessarily lead men to a higher state of mental training, and impart to them ideas of workmanship, of citizenship, and of moral and intellectual manhood.

ORGANIZED RELIEF.

S. R. Barr, Superintendent, Relief Department, Baltimore & Ohio Railroad, Baltimore, Md.

The first successful attempt to organize an institution for the relief of employees of railroad companies was made by the Baltimore & Ohio Railroad Co. on May 1, 1880. This was followed by a similar action on the part of the Pennsylvania Railroad Co. on its lines east of Pittsburgh and Erie, in 1886; the Philadelphia & Reading Railroad, on October 30, 1888; the Chicago, Burlington & Quincy Railroad, on March 15, 1889; the Pennsylvania Railroad—lines west of Pittsburgh and Erie, on April 16, 1889; the Atlantic Coast Line Railroad, on April 1, 1899; the Western Maryland Railroad Co., in the early part of 1908, and the Washington Terminal Railroad Co. on October 1, 1908.

These eight relief departments are the only ones under consideration in this paper. Although relief and hospital funds in various forms are maintained upon the lines of other companies, they are not of the comprehensive character of those referred to. These eight departments are, so far as concerns the contributions required from members, and the payment of benefits for disablements and death, practically on the same basis.

Membership is compulsory in some and voluntary in others, but provision is made in all of them for the payment of practically the same benefits in cases of disability from sickness, accident, and for death.

On account of long connection and greater experience with its operation, I shall confine my remarks mainly to the relief department of the Baltimore & Ohio Railroad Co. These departments are managed by what are termed "committees" composed of equal representation of the members and of the companies; the latter reserve the right to have all changes in the rules receive the approval of their directories before becoming effective.

The companies contribute, first, by establishing and maintaining the departments as a part of their service; second, by giving the services of their officers and agents, and the use of their facilities for conducting the departments' business; third, by holding the departments' moneys as a trust fund and paying interest on monthly cash balances at the rate of 4 per cent per annum; fourth, by guaranteeing the faithful performance of all the obligations of the departments and agreeing to make good any deficit arising at the end of each fiscal year, regardless of any surplus the departments may have as the result of their operations in previous years.

The following table from the regulations of the Baltimore & Ohio relief department shows the contributions and the benefits guaranteed to be paid therefor:

Classes.	A.	B.	C.	D.	E.
Rates of contributions per month:					
First class [a]	$1.00	$2.00	$3.00	$4.00	$5.00
Second class [b]	.75	1.50	2.25	3.00	3.75
Entitling to benefits:					
For accidental injuries, per day, not including Sundays—					
First 52 weeks	.50	1.00	1.50	2.00	2.50
After 52 weeks	.25	.50	.75	1.00	1.25
For sickness, per day, not including first six working days or Sundays—					
First 52 weeks	.50	1.00	1.50	2.00	2.50
After 52 weeks	.25	.50	.75	1.00	1.25
In the event of death from—					
Accidental injuries	500.00	1,000.00	1,500.00	2,000.00	2,500.00
Natural causes	250.00	500.00	750.00	1,000.00	1,250.00

[a] Those engaged in the operation of trains. [b] Those not so engaged.

The classes to which members are assigned are determined by their monthly wages, with the idea of securing to them approximately half their wages when disabled. This classification is as follows:

Class A.—Those receiving not more than $35.
Class B.—Those receiving more than $35 and not more than $50.
Class C.—Those receiving more than $50 and not more than $75.
Class D.—Those receiving more than $75 and not more than $100.
Class E.—Those receiving more than $100.

Any member while in the service may enter a higher class than that to which his wages assign him, provided he is not over 50 years of age and can pass a satisfactory medical examination.

The benefits for disability, whether resulting from accident or sickness, are payable at full rates for 52 weeks and at half rates thereafter during the continuance of the disability, no matter of how long duration.

While entitled to benefits members are not required to make any contributions. Free surgical and hospital attention is furnished as long as may be necessary in cases of accidental injury, and artificial limbs or other appliances are supplied without cost when the member's condition can be benefited thereby. Whenever necessary these appliances are renewed.

Systematic inspection is made of the members' surroundings, and all matters affecting their health, comfort, or safety are promptly reported. Fully instructed first-aid corps are established among all classes of employees, and first-aid packets are carried on all trains and are placed in all shops. Further attention is given to their safety by requiring all persons entering the service to pass a rigid physical examination in order to prevent the employment of those physically or mentally unfit to properly perform their duties or who would be unsafe by reason of defective sight, hearing, or color sense.

A member leaving the service or while temporarily absent can retain his life insurance (called natural-death benefits) by making the required contribution (25 cents per month for each $250), and may also retain his full membership during an absence not exceeding 30 days. Up to this point the railroad relief departments are practically the same.

In connection with its relief department the Baltimore & Ohio Railroad has what is termed a "pension feature," the funds for the support of which are provided from the company's treasury, none of the contributions from members being used for this purpose.

The following table shows the benefits payable under this feature:

	10 years' membership and under one-half sick rate.	15 years' membership, 5 per cent additional.	20 years' membership, 10 per cent additional.
Those contributing under relief feature to class A	$0.25	$0.26¼	$0.27½
Those contributing under relief feature to class B	.50	.52½	.55
Those contributing under relief feature to class C	.75	.78¾	.82½
Those contributing under relief feature to class D	1.00	1.05	1.10
Those contributing under relief feature to class E	1.25	1.31¼	1.37½

Any employee reaching the age of 65, and having served the company for not less than 10 years, is eligible for pension, although he is not required to retire.

The addition of this feature would seem to make a complete system of relief, every exigency of a workingman's life being provided for. He is protected when disabled by sickness, injury, and old age, and his family, in some degree, in the event of his death.

The savings feature is another adjunct of the department, and was established for the purpose of enabling the employees of the company, their wives, children, fathers, and mothers, or the beneficiaries of deceased members, to safely deposit their savings in any sums not less than $1 nor more than $100 in any day. These deposits can be withdrawn on demand, no time notice being required. If withdrawn before the close of the fiscal year, 4 per cent is paid; but if allowed to remain until the close of the year, this interest is increased by the addition of the profits resulting from the investments of the funds. This dividend is usually more than 1 per cent.

These deposits are a trust fund, and the company fully guarantees their safety. A depositor may continue his account upon severing his connection with the service, if he then has not less than $50 to his credit.

These deposits are loaned to employees for the purpose of acquiring, improving, or releasing liens upon a homestead situated, except in the cities, within a mile of the company's lines. Six per cent interest is charged upon such loans. No loan is made in excess of three-fourths of the value of the property offered as security. Loans are repaid upon the basis of 1, 1¼, and 1½ per cent monthly by deduction from wages earned.

The interest charge is adjusted whenever a payment is made on the principal. This is perhaps best illustrated by showing a $1,000 loan to be repaid at the rate of 1½ per cent per month.

Principal	$1,000.00
Interest first month	5.00
	1,005.00
First payment	15.00
	990.00
Interest second month	4.95
	994.95
Second payment	15.00
	979.95

And so on, for a period of 82 months, if regular payments are made, when the loan is fully repaid, with a total interest charge of $219.43.

There are no fines or other penalties for temporary failure to meet the required payments, and borrowers are not expected, or required, when not earning wages by reason of disabilities, to make the payments.

As might be expected, many thousands have taken advantage of this opportunity to provide themselves with homes. This feature has been in operation for such a length of time that property owners do not hesitate to take a second mortgage on the properties sold to our employees who are not able to pay all, or even any portion, of the difference between the purchase price and the amount the department will lend.

It has not been thought necessary to make any detailed statement of the amounts paid out through the relief departments, amounting, as they do, to many millions.

Every attempt to improve human conditions has met with adverse criticism and opposition, and relief departments have not escaped such difficulties, but by perseverance and just dealing they have gone on with their work, and it may be safely said that to-day they have a contented membership.

THE ACCIDENT PROBLEM OF THE RAILROADS.

FRANCIS DENISON PATTERSON, M. D., Chief Surgeon Philadelphia & Western Railway Co., Philadelphia, Pa.

The accident problem of the American railroads is to-day a serious one; more so than in other countries, for here the demand of the public is for speed, both for their own constant traveling and for the movement of their freight and express matter, and this over tracks which are, but in rare instances, protected by a properly inclosed right of way, and with countless grade crossings not always guarded, each one of which may become the site of a catastrophe.

The problem is serious, both by reason of its accompanying mortality and consequent economic loss to the community at large, and also because the moneys paid in the settlement of personal-injury cases is an operating expense of material amount, and these can be best illustrated by a brief review of some recent statistics.

The reports of the Interstate Commerce Commission show that, from 1888 to the end of December, 1911, 68,345 employees were killed and 1,180,782 were injured, and, in the same period, 7,305 passengers were killed and 161,976 were injured. From 1888 to 1909, inclusive, 108,167 other persons were killed and 149,777 were injured.

Analysis of the figures for the year 1910 shows that during that year 6,768 persons were killed, an average of over 18 a day, and 82,915 were injured, an average of over 227 a day. In 1911, 9,842 were killed, an average of over 26 a day, and 71,832 were injured, an average of over 196 for each of the 365 days of this year.

By far the greater number of these injured persons are employees, and a further study shows that accidents to them are greatly on the

increase. During the year 1890, 1 out of every 33 employees was injured. In 1911 this had increased to 1 out of every 13. In 1890, 1 out of every 12 trainmen (engineers, firemen, conductors, and brakemen) was injured, while in 1911 this had increased to 1 out of every 8; and it should be remembered that these reports do not record any injuries where the disability is less than a period of three days, and so the number who sustain some form of injury is unquestionably underestimated.

The reports of the Federal employer's liability and workmen's compensation commissions emphasizes another serious phase of the problem. It states the experience of the companies operating one-half of the total railway mileage of the United States, employing nearly 57 per cent of all railway employees, excluding officers, and paying 59.3 per cent of the wages of all railway employees, excluding officers, and covering the three years of 1908, 1909, and 1910.

Briefly, the report shows that 5,948 employees met with fatal accidents, that their average age was 35 years, and that the total of days lost from their life expectation reaches the enormous figure of 69,914,482.

Two hundred and seventy-nine employees met with an accident which resulted in their total disability, and these comprised: Loss of both feet, 100 cases; loss of both hands, 9 cases; loss of both eyes, 7 cases; loss of one hand and one foot, 27 cases; other unspecified injuries, 136 cases. The average age of these employees at the time of accident was 34 years, and the total number of days lost from their life expectation was 3,286,799.

There were 2,642 cases of permanent partial disability, and these comprised: Loss of one hand, 481 cases; loss of one foot, 893 cases; loss of one eye, 390 cases; other unspecified injuries, 878 cases. The average age of these employees was 33 years, and the total number of days lost from their life expectation was 4,355,281.

There were 79,613 cases of temporary disability of over two weeks, and these lost a total of 3,260,433 days from work.

There were 253,680 other cases where the disability was two weeks and under.

The cost of these accidents to the companies in settlements and judgments was $17,940,631, a figure which would be vastly increased had the cases been adjusted under the provisions of the proposed Federal law.

The civilized world stood aghast when the *Titanic*, with her name of ill omen, crashed into an iceberg and some 1,500 souls perished amidst the ice floes. An ever-generous public subscribed more than $2,000,000 for the relief of those made dependent by the catastrophe, and countless columns of every newspaper were devoted to every phase of the horror; but the vastly greater number of persons who are

maimed or killed by the railroads every month passes practically unnoticed by both press and public.

All railroad accidents are due to some one of three causes—first, a defect in material; second, its failure to work properly; third, the failure, sometimes of employees and sometimes of the injured person, to exercise the proper care.

It is per se the duty of the management of the railroads to obviate the first and second of these three causes, a course which for them is not always easy, for the regulation of rates by the Government has made it a more or less difficult problem to maintain the equipment at the highest possible standard.

It is not for me to question the present tendency toward paternalism in our Government, but I deem it my duty to draw attention to the fact that it not only limits the transportation rate, but at the same time is endeavoring to fix by legislation the moneys which must be paid in compensation of any accident, which, however, may be caused by depreciated equipment, due to the failure of the railroads to receive an adequate compensation for their services.

My plan of accident prevention deals solely with the third cause, the failure to exercise proper care, and the plan applies equally to, first, the employee, second, the passenger, and, third, the public in general.

First, the employee: The failure to take proper care should bring home to each one the sense of his personal responsibility in the prevention of accidents. The employee who habitually takes chances instead of taking care is mentally unfit for employment in any capacity in the railroad service.

Proper care taken to operate proper equipment, and, furthermore, proper care taken to see that this equipment works properly would obviate the occurrence of the majority of accidents.

Proper care can be taken only by an employee who is physically and mentally competent, and this can be accurately determined only by a physical examination by a physician.

This examination should comprise a complete test of the applicant's physical and mental capacity for the position for which he applies. The form which I devised, and which has proved in every way satisfactory in my service on the Philadelphia & Western Railway, is the following:

PHYSICAL EXAMINATION BLANK.

Name_____Birthday_____Age_____

Birthplace_____Occupation_____

Residence_____

Are you a citizen of the United States?_____

If not, have you made application and in what court?_____

Have you ever applied to any insurance or beneficial association for membership or for enlistment in the Army, Navy, Marine Corps, or National Guard or for employment to any railroad company and been rejected by reason of physical disability?_____

What sickness have you had, and at what age?_____

What are the ages of your parents, and if either parent has died, state age at death and cause of death?_____

_____

How many brothers and sisters living and their condition of health?_____

_____

If brother or sister has died, state age at death and cause of death_____

_____

Did any member of your family ever suffer from either consumption or insanity? _____

Have you found your health or your habits to interfere with your success in life?_____

Is there anyone in the house in which you live that suffers from consumption?

_____

Are you subject to dizziness or vertigo, epileptic or other fits?_____

To headache?_____To pain in the chest?_____.

To fluttering of the heart?_____To shortness of breath?_____.

To colds in the head?_____To cough?_____

To hoarseness?_____To diarrhea?_____.

To piles, fistula, or any other rectal disease?_____

To rheumatism or to lumbago?_____

To varicose veins?_____

Do you believe that you are sound and well at this time?_____

Have you had sore eyes or any defect of vision?_____

Have you had—A. Asthma?_____H. Running from either ear?_____.

B. Spitting of blood?_____I. Gonorrhea, and when?_____

C. Dyspepsia?_____J. Sore of any kind upon the penis, and

D. Appendicitis?_____ when?_____

E. Gall stones?_____K. A boil near the anus (fistula)?_____.

F. Gravel?_____L. Malaria?_____.

G. Any defect in hearing?_____ M. Cancer or other tumor?_____

Have you ever had any ulcers or open sores?_____

Do you drink intoxicating liquors, and if so to what extent?_____

Have you ever taken a cure for the liquor or drug habit?_____

Do you take narcotics?_____

Do you use tobacco? If so, in what form?_____

Have you ever been injured upon the head?_____

Have you ever had paralysis or any other nervous trouble?_____

Have you had a sprain?_____Or a stiff joint?_____

Or a bone broken?_____Or a bone or joint out of place?_____

Have you lost or gained weight within the last six months, and how much?

_____

Mention carefully any serious illnesses that you may have had, and the length of time you were ill_____

Mention carefully any injuries or surgical operations that you may have had upon any part of your body_____

Have you been successfully vaccinated? If so, when?_____

When did you last consult a physician professionally, and for what?_____

_____

When and for what and for how long were you last confined to the house by illness?_____

I declare these answers to be true, and I agree that any misstatement will be a just cause for dismissal.

_____	_____	_____
Signature of witness.	Date of application.	Signature of applicant.

PHYSICAL EXAMINATION.

Figure and general appearance_____

Height_____Weight _____Temperature _____

Color of hair_____Color of eyes_____

Missing teeth:

	Right.								Left.							
Upper_____	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Lower_____	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

Eye tests—Acuteness of vision:

Right eye_____Left eye_____Both eyes_____

Corrections with glasses_____

Range of vision (number of the test type read at 8 inches):

Right eye, No_____Left eye, No_____Both eyes, No_____

Field of vision_____

Right eye_____Left eye_____Both eyes_____

Correction with glasses_____

Any disease of eyes or lids?_____

Field of vision_____

Right eye_____Left eye_____Both eyes_____

Color sense—Test skeins_____

1. Green_____2. Rose_____

3. Red_____4. Blue_____

Colors selected to match—Selection prompt or hesitating?_____

Lantern test.

Number shown	1		3	4	5	6	7
Name given							
Letter shown	A	B	C	D	E	F	G
Name given							

Remarks _____

EAR TESTS.

Hearing right ear—conversation_____feet_____

acoumeter_____feet_____

watch_____inches_____

Hearing left ear—conversation_____feet_____

acoumeter_____feet_____

watch_____inches_____

Remarks _____

Heart_____condition of blood vessels_____

Pulse rate, at rest_____after exercise_____

Chest, expiration_____inspiration_____mobility_____

Lungs_____

Frequency of respiration per minute_____at rest_____after exercise_____

Waist measurement_____

Abdomen and contained organs:

Spine_____reflexes_____

Kidneys:

Urine examination: Color_____Reaction_____S. G_____

Albumen_____Sugar_____

Upper extremities_____

Scrotum _____

Lower extremities_____

Skin_____Vaccination_____

Physically: First class_____Average_____Defective_____

Mentally: Alert_____Average_____Dull_____

Remarks _____

I have this day examined_____who is an applicant for the position of_____and I find him physically_____competent to fill the duties of that position.

_____

Chief surgeon.

Place of examination_____

Date of examination_____

With the view of obtaining information as to the methods of the larger steam and electric railway systems in this country, I recently sent out a circular letter, and received replies from the management of 54 of the steam and 87 of the electric systems. In reply to my question as to whether or not they required applicants for employment to pass a physical examination, 51 of the steam roads answered that they required an examination, while the other 3 did not. Of these 51 roads, 33 require that the tests for vision, hearing, and color perception be made by the physician who conducts the physical examination, while the other 18 roads have these tests made by an employee who is not a physician, and 8 of these roads make no other examination than the tests for vision, hearing, and color perception.

I can but believe, from my experience during the past 16 years, that the value to be placed on any physical examination depends on the thoroughness with which it is performed. I do not consider a trainmaster or an air-brake inspector competent to determine the physical or mental qualifications of an applicant for employment in the operating or any other department of the railroad service. I am convinced that the examination of the heart, the lungs, the nervous system, the urine, and the determination of the blood pressure are equally as important as the examination of the eyes and the ears, and this presumes that the nonmedical examiner has had the training to make the examination properly.

" Safety appliances require safe men to operate them " is an axiom too often disregarded by the management of American railroads. The most modern form of block-signal system is of no possible protection to any train at night when a color-blind engineer is at the throttle, or at any time, if the engineer is lifeless from some disease, the presence of which would have been determined by a thorough physical examination.

The employment of any man in the operating department of a railroad, without submitting him to a physical examination by a physician prior to his appointment, and the failure to reexamine him at frequent intervals, is courting a disaster which may be titanic in size, if not in name. This should be just as criminal as it is foolish to drive a ship at full speed amidst the icebergs, not heeding the

warnings from other vessels as to their presence. No company need hesitate over the question of expense, for the medical department can be made self-sustaining by charging the applicant a fee for the examination.

Of the steam railroads which require a physical examination, in 11, it is made at the expense of the company; in 19, it is made at the expense of the applicant, if accepted, and at the expense of the company, if rejected; in 9, it is made at the expense of the applicant, whether accepted or rejected; in one instance, it is made at the expense of the company, if accepted, and at the expense of the applicant, if rejected.

The cost of these examinations to the applicant varies from $1 to $2. In the electric roads, in nearly every instance, the cost of the examinations is placed on the applicant, the fee varying from 50 cents to $2.50, but the average charge is $1.

I consider it of the utmost importance that all employees of the operating department should be reexamined at a yearly interval, and before resuming work after an absence from duty, for a period of three days or longer, by reason of either illness or injury. In this way, those who have become physically unfit would be displaced from positions where their physical infirmity might be the cause of an accident. Such is my practice in my service, and the form which I use in these reexaminations is the following:

EMPLOYEES' PHYSICAL EXAMINATION BLANK.

Name_____Age_____

Residence_____Position_____

Length of service with Philadelphia & Western Railway Co_____

What sickness have you had and at what age?_____

What are the ages of your parents, and if either parent has died, state age at death and cause of death?_____

_____

How many brothers and sisters living, their ages and their condition of health?

_____

If brother or sister has died, state age at death and cause of death_____

_____

Did you or any member of your family ever suffer from either consumption or insanity?_____

Is there any one in the house in which you live that suffers from consumption?

_____

Have you ever had any ulcers or open sores?_____

Have you lost or gained weight within the last six months, and if so, how much?

_____

Mention carefully any serious illnesses that you may have had and their date and the length of time you were ill_____

_____

Mention carefully any injuries or surgical operations that you may have had upon any part of your body_____

_____

Have you been successfully vaccinated?_____If so, when?_____

When did you last consult a physician professionally and for what?_____

_____

His name and address_____

When, for what, and for how long were you last confined to the house by reason of illness?_____

_____

Do you use tobacco?_____If so, in what form and in what amount?_____

_____

Do you drink intoxicating liquors?_____

Have you ever taken them to excess?_____

I declare these answers to be true and I agree that any misstatement will be a just cause for dismissal.

_____

(Signature of employee.)

_____Witness. Date_____

PHYSICAL EXAMINATION.

Figure and general appearance_____

Height_____ Weight_____ Temperature_____

Color of hair_____Color of eyes_____

Eye tests—Acuteness of vision:

Right eye_____Left eye_____Both eyes_____

Corrections with glasses_____

Range of vision (number of the test type read at 8 inches):

Right eye, No_____Left eye, No_____Both eyes, No_____

Field of vision_____

Right eye_____Left eye_____Both eyes_____

Correction with glasses_____

Any disease of eyes or lids?_____

Field of vision_____

Right eye_____Left eye_____Both eyes_____

Color sense—Test skeins_____

1. Green_____2. Rose_____

3. Red_____4. Blue_____

Colors selected to match—Selection prompt or hesitating_____

Lantern test.

Number shown	1	2	3	4	5	6	7
Name given							
Letter shown	A	B	C	D	E	F	G
Name given							

Remarks _____

EAR TESTS.

Hearing right ear—conversation_____feet_____

acoumeter_____feet_____

watch_____inches_____

Hearing left ear—conversation_____feet_____

acoumeter_____feet_____

watch_____inches_____

Remarks _____

_____

Heart_____condition of blood vessels_____

Pulse rate, at rest_____after exercise_____

Chest, expiration_____inspiration_____mobility_____

Lungs_____

Frequency of respiration per minute_____at rest_____after exercise_____

Remarks _____

Abdomen and contained organs.

Remarks _____

Spine _____reflex_____

Remarks _____

Kidneys.

Urine examination: Color_____Reaction_____S. G_____

Albumen_____Sugar_____

Remarks _____

Upper extremities_____

Scrotum_____

Lower extremities_____

Remarks _____

Skin_____Vaccination_____

Physically: First class_____Average_____Defective_____

Mentally: Alert_____Average_____Dull_____

Remarks_____

I have this day examined _____ _____, whose position is that of _____, and I find him physically _____ competent to fill the duties of that position.

_____,

Chief Surgeon.

Place of examination_____

Date of examination_____

The space at my disposal does not permit of the consideration in detail of the relation of fatigue to efficiency; excessive working hours on the part of employees of necessity increases the liability to an accident. As Goldmark, in her admirable study, Fatigue and Efficiency, has pointed out: "After fatigue has set in the faculty of attention is in inverse ratio to the duration and intensity of the work undertaken, and when the brain is fatigued attention flags." For any employee to discharge his duties with the utmost efficiency it is necessary that his hours of work be followed by both mental and physical rest. No employee should be required to be on duty for a longer period than 12 consecutive hours, and then there should be at least a period of rest of 8 hours before again returning to duty.

It is my practice to caution our employees as to the value of proper rest in promoting efficiency, and to further instruct them that alcohol is a poison; to tell them of the importance of fresh air and of personal cleanliness and that venereal disease disqualifies them from further employment with the company.

Second, the passenger, and, third, the public in general: As regards the passenger, it is and should be contributory negligence for anyone not to take the proper care, but it is equally the duty of the railroads, as a means of accident prevention, to impress upon them and upon the public in general through newspaper advertisements, the distribution of printed matter, and by signs the necessity for such care. Passengers should be told the right and the wrong way to board and alight from trains; they should be cautioned against getting on or off moving cars, etc.

A campaign of vigorous prosecution should be waged against trespassers upon any portion of the property of any railroad company. The reports of the Interstate Commerce Commission show that in the decade from June 30, 1901, to June 30, 1911, 50,708 trespassers were killed and 54,183 were injured; some 13,000 of these were under the age of 14 years and some 20,000 between the ages of 14 and 21. Such a campaign would unquestionably save many of these lives, the sacrifice of which passes practically unheeded.

Whenever a personal-injury case occurs, whether the unfortunate person be employee, passenger, or trespasser, it should receive the attention of a physician at the earliest possible moment, for humanitarian if for no other reason. Furthermore, every employee in the operating department should be instructed in the principles of first aid, and be equipped with an emergency packet, so that he may render immediate and intelligent assistance until a physician arrives and assumes charge of the case. I make a record upon the following form of the first-aid treatment and physical examination of our accident cases, and have found its use in every way satisfactory:

SURGEON'S ACCIDENT REPORT.

Name, _____; residence, _____;

nationality, _____; age, _____; sex, _____;

physique, _____; color of hair, _____

beard, _____; moustache, _____; clean shaven, _____;

married, _____; single, _____; widow, _____; divorced, _____; separated, _____;

children, number and ages, ----------;

occupation, ----------;

name and address of employer, ----------;

earnings amount to $---------- per ----------;

employee, ----------; passenger, ----------; traveler on highway or foot or in vehicle, ----------; trespasser, ----------;

place of accident, ---------; date of accident, ---------; time of accident, ------;

state in the patient's own words the cause of the injury and the manner of its occurrence, ----------

----

----------;

witnesses, ----------;

nearest relative and address, ----------;

where and how taken after the accident, ----------;

when first consulted a physician and his name and address, ----------

----------;

attending physician's name and address, ----------;

names and addresses of former physicians, ----------

----------;

statement of the attending physician, including a résumé of the treatment,

----

----------;

name and address of consultant or assistant, ----------;

previous history, ----------

----------;

hereditary influences, ----------;

health (Is there any evidence of any disease or infirmity irrespective of this accident?), _____; accident, _____.

PHYSICAL EXAMINATION.

(The applicant should be stripped as much as may be necessary.)

Weight, _____; height, _____;

nature and extent of injuries, _____;

constitutional symptoms, _____;

local symptoms, _____;

diagnosis, _____;

prognosis, _____;

the probable period of disability should be estimated in days, weeks, or months, _____; do you find that the injuries are such as to necessarily disable the person from performing the usual duties of their occupation? _____;

if any permanent disability or deformity is likely to result, state your opinion as to the extent it will affect the patient's ability to perform the duties of his present occupation, _____

_____;

at the time of the examination was the injured person in bed, in a chair, or up and about? _____

_____;

does the patient carry accident insurance; if so, in what company and in what amount? _____

_____;

is the patient a member of any fraternal order which has an insurance feature, and the name and address of the physician of the same? _____

_____;

is there any evidence that the patient was under the influence of either alco-

holic liquors or narcotics at the time of the accident? _____;

has the patient any relative that has previously been injured or has had litigation with any traction or railroad company? _____;

place of examination, _____; date of examination, _____;

persons present during the examination, _____

_____;

state any additional information which you may deem would prove of either interest or profit to the company, _____

_____.

Of the 54 steam roads that answered my inquiry 43 make an immediate examination of all accident cases, while 11 have the examination made only after the case has been investigated by the claim department; 50 of these roads use a form upon which the physicians make their report, while the other 4 roads have the reports made by letter. Of the 85 electric roads 60 use a form, and the balance have reports made by letter.

In my judgment, the immediate examination of all accident cases has the advantage of insuring to the company accurate knowledge as to the degree of the injury and its prognosis and greatly facilitates the early settlement of the case.

In conclusion it may be stated that the adoption of this plan by any company would decrease its accident account by excluding the physically unfit from employment, and the reexamination of the employees of the operating department at frequent intervals would insure the displacement of those who for any reason had become physically incompetent and whose physical defect might be the cause of accident.

The public can be educated to lend their aid in the prevention of accidents, and many accidents which are now of frequent occurence would become comparatively infrequent.

The first-aid treatment and at the same time physical examination of every case of personal injury would insure to the company information which would be of invaluable assistance in securing prompt settlement of the case.

This plan is not an experiment. It has been in use during the past seven years in the road of which I have the honor to be the chief surgeon, and during that time we have had but three accidents, all to passengers and all of a minor nature. One of these was due to

the company's negligence in allowing a board in a platform to become loose, and the passenger fell while stepping upon it. This case was settled for $25. The other two accidents were caused by passengers not looking where they were walking, and each stepped down between the platform of the car and the platform of a station. As the company was not negligent, no damages were paid in either of these cases.

ZUSAMMENSTELLUNG DER VERORDNUNGEN, EINRICHTUNGEN UND MASSNAHMEN, WELCHE IN DEUTSCHLAND UND IN ANDEREN LÄNDERN, VON SEITEN DER VERWALTUNGEN UND VON VEREINEN GETROFFEN SIND IM KAMPFE GEGEN DEN ALKOHOLISMUS BEI DER EISENBAHN.

Sanitätsrat Dr. CONRAD GAYE, Bahnarzt in Stettin.

Wenn auch schon in früheren Jahren von Seiten der Preussisch-Hessischen Eisenbahngemeinschaft verschiedene Verordnungen und Erlasse gegen den Alkoholmissbrauch ergangen und eine Reihe von Wohlfahrtseinrichtungen getroffen waren, so beginnt doch der energische und zielbewusste Kampf gegen den Alkoholismus erst im Jahre 1905, nach den, durch angetrunkene Beamte verursachten Eisenbahnunfällen bei Spremberg, Tilsit und Czernitz.

Am 20. November, 1905, erliess der verstorbene Minister der öffentlichen Arbeiten von Budde den folgenden Erlass (No. 571, betr. Verbot des Genusses alkoholhaltiger Getränke während des Dienstes) und einen zweiten Erlass Nr. 572, betr. Wohlfahrtseinrichtungen:

NR. 571. BETR. VERBOT DES GENUSSES ALKOHOLHALTIGER GETRÄNKE WÄHREND DES DIENSTES.

BERLIN, *den 20. November, 1905.*

Wiederholt ist von mir auf die Nachteile hingewiesen worden, die der Missbrauch alkoholischer Getränke für die körperliche und geistige Spannkraft der Bediensteten sowie für ihr Familienleben und für den Dienst mit sich bringt. Gleichzeitig habe ich Mittel und Wege angegeben, die geeignet erscheinen, den Alkoholgenuss einzuschränken. Die Königlichen Eisenbahndirektionen sind angewiesen, fortgesetzt hinzuwirken: auf die Herstellung und angemessene Ausstattung von Aufenthalts- und Uebernachtungsräumen, auf die Fürsorge für billige und nahrhafte Verpflegung, insbesondere für das Personal, das genötigt ist, die Mahlzeiten ausserhalb der Häuslichkeit einzunehmen, ferner auf die eisenbahnseitige Vorhaltung alkoholfreier Getränke, die Einrichtung von Kantinen, Lesezimmern u. s. w. Die Mitnahme von Schnaps und schnapsähnlichen Geträn-

ken in den Dienst ist bei Strafe verboten, und der Verkauf dieser Getränke in den Kantinen u. s. w. untersagt. Auch soll durch Belehrung seitens der Vorgesetzten und Bahnärzte sowie durch Vorträge in den Eisenbahnvereinen das Verständnis für die Gefahren des Alkoholgenusses geweckt und das Ehrgefühl zur Bekämpfung des Alkoholmissbrauches angeregt werden. Mehrfach wurden auch die Direktionen aufgefordert, Fälle von Trunkenheit während des Dienstes mit Strenge zu ahnden und Bedienstete scharf zu überwachen, die sich dem übermässigen Alkoholgenusse hingeben.

Gern erkenne ich an, dass Beamte und Arbeiter die grosse Bedeutung dieser Anordnung im allgemeinen wohl erkannt haben. Gewissenhafte Bedienstete unterlassen schon jetzt im Aussenbetriebe aus freien Stücken vor dem Dienst und während der Dienststunden jeden Alkoholgenuss, weil er ihnen mit den Anforderungen, die der Betrieb an ihre Spannkraft stellt, nicht verträglich erscheint. Auch die Eisenbahndirektionen waren bemüht, den Bediensteten den Entschluss, sich vom Alkoholgenuss fern zu halten, durch zweckmässige Einrichtungen zu erleichtern.

Dennoch haben schwerwiegende Vorkomnisse der letzten Zeit gezeigt, dass die bisherigen Massnahmen nicht ausreichen, um zu verhüten, dass Bedienstete sich in sträflicher Pflichtvergessenheit durch übermässigen Alkoholgenuss zur Verrichtung ihrer dienstlichen Obliegenheiten unfähig machten und dadurch Betriebsunfälle schlimmster Art veranlassten. Gegenüber den Anforderungen, die der Betriebsdienst in steigendem Masse an die Umsicht und die Entschlussfähigkeit der in diesem Dienst beschäftigten Beamten und Arbeiter stellt und stellen muss, ist es für jeden eine unerlässliche Pflicht, sich jene Eigenschaften ungeschwächt zu erhalten, und alles zu vermeiden, was den klaren Blick trüben, die Willenskraft lähmen kann.

Dass der Alkoholgenuss eine Beeinträchtigung der Leistungsfähigkeit zur Folge hat, ist nicht allein durch die ernsten Erfahrungen im Eisenbahndienst sondern auch auf vielen anderen Arbeitsgebieten erwiesen.

Es muss daher allen im Betriebsdienste, einschliesslich des Fahr-, Rangier- und Bahnbewachungsdienstes tätigen Beamten, Hilfsbeamten und Arbeitern, ferner allen im Bahnsteigschaffner-, Portier- und Wächterdienst beschäftigten Bediensteten der Genuss alkoholhaltiger Getränke jeder Art während des Dienstes fortan untersagt werden. Die Durchführung dieses Verbotes ist mit Strenge zu überwachen und im Wege der Disziplin, besonders auch durch Zurückziehung aus dem Betriebe, Ausschliessung von Anstellung, Gehaltszulagen und Beförderung sicher zu stellen. Als Dienst im Sinne dieses Verbotes ist auch die Dauer der Dienstbereitschaft im Bahnbereich anzusehen.

Ob das Verbot auch auf weitere Dienstklassen auszudehnen ist, bleibt dem Ermessen der Königlichen Eisenbahndirektionen überlassen.

Um eine Gewähr dafür zu erhalten, dass Beamte und Arbeiter ihren Dienst nicht in einem durch Alkoholgenuss geschwächten Zustande beginnen, ist überall da, wo es die Oertlichkeit erlaubt, anzuordnen, dass die Mannschaften der obengenannten Dienstzweige sich vor dem Dienstantritt auf der Station bei ihrem nächsten Dienstvorgesetzten oder dessen Vertreter zu melden haben.

Sollten noch fernerhin Fälle von Trunkenheit im Dienst vorkommen, sind die Schuldigen, falls keine härtere Strafe angezeigt ist, mindestens mit einer empfindlichen Geldstrafe zu belegen und unter Androhung der Dienstentlassung für den Wiederholungsfall sofort aus dem Betriebsdienste zurüchzuziehen. Im Betriebsdienste dürfen sie nur mit besonderer Genehmigung der Eisenbahndirektion und erst dann wieder verwendet werden, wenn mit Bestimmtheit angenommen werden kann, dass sie ein gleiches Vergehen sich nicht wieder zu schulden kommen lassen werden. Bei wiederholter Trunkenheit im Dienst ist stets die Dienstentlassung anzuordnen oder das Disziplinarverfahren auf Dienstentlassung einzeleiten.

Da die Abwendung schwerer Gefahren für den Betrieb sowie für das Leben der Beamten und Arbeiter in Frage steht, so hat jeder Eisenbahnbedienstete, welcher bemerkt, dass in den obenaufgeführten Dienstzweigen jemand bei angetrunkenem Zustande seinen Dienst verrichtet oder ihn zu verrichten sich anschickt, sofort dem nächsten erreichbaren Vorgesetzten des dienstunfähigen Mannes Meldung zu erstatten. Dem Vorgesetzten liegt ob, wegen etwaiger Ablösung das Nötige zu veranlassen.

Vorgesetzte, welche unterlassen, ihre Untergebenen hinsichtlich des Alkoholmissbrauchs zu beobachten und zur Rechenschaft zu ziehen, machen sich selbst einer Pflichtverletzung schuldig.

Von dem Ehr- und Pflichtgefühl aller Glieder der Staatseisenbahnverwaltung erwarte ich, dass sie sich von der Notwendigkeit dieser Massregel im Hinblick auf die Sicherheit des Betriebes und auf ihren eigenen Schutz gegen Lebensgefahr überzeugen werden und dass ein jeder von ihnen, soviel an ihm liegt, dazu beitragen wird, die getroffenen Anordnung überall zur Durchführung zu bringen.

Dabei rechne ich auch auf die vielfach bewährte Mitwirkung der Bahn- und Bahnkassenärzte, die nicht nur durch belehrende Vorträge auf die Bediensteten einwirken, sondern auch die Vorgesetzten auf solche Bedienstete aufmerksam machen können, welche nach ihrer Kenntnis dem Alkoholmissbrauch in einem Umfang ergeben sind, dass dadurch die Zuverlässigkeit ihrer dienstlichen Verrichtungen in Frage gestellt wird. Hierauf werden die Bahnärzte ins-

besondere auch bei der Untersuchung solcher Personen zu achten haben, deren erste Einstellung in den Eisenbahndienst in Frage kommt.

Der Bezug alkoholfreier erfrischender Getränke ist in immer grösserem Umfange, insbesondere auch dem auf weiter Fahrt diensttuenden Personal nach Möglichkeit zu erleichtern und entsprechenden Einrichtungen von den Eisenbahndirektionen ganz besondere Aufmerksamkeit zuzuwenden.

Die Eisenbahndirektionen wollen hiernach das für ihren Bezirk Erforderliche veranlassen.

An die Königlichen Eisenbahndirektionen.

IV, B. 5, 915.

NR. 572. BETR. WOHLFAHRTSEINRICHTUNGEN.

BERLIN, *den 20. November, 1905.*

Durch einen Erlass vom heutigen Tage (IV, B. 5, 915, E. N. Bl., S. 403) habe ich es für gewisse Klassen der Eisenbahnbediensteten als unumgänglich notwendig bezeichnet, dass sie sich des Genusses alkoholischer Getränke während des Dienstes enthalten und habe demgemäss angeordnet, dass diesen Bediensteten der Genuss solcher Getränke während des Dienstes zu untersagen sei.

Bei dieser Anordnung ist für mich auch die Erwägung massgebend gewesen, dass infolge der in letzter Zeit auf allen Gebieten der Wohlfahrtspflege für die Eisenbahnbediensteten getroffenen Verbesserungen, das Verbot des Alkoholgenusses während des Dienstes keine Härte mehr in sich schliesst, weil die Eisenbahndirektionen schon jetzt in grösserem Umfange Einrichtungen getroffen haben, die den Bediensteten ermöglichen, je nach der Jahreszeit wärmende oder kühlende alkaholfreie Getränke sich entweder selbst zuzubereiten oder sich zu mässigen Preisen zu beschaffen. Es erscheint aber notwendig, mit der planmässigen Schaffung von Gelegenheiten zum Einnehmen solcher Getränke noch weiter vorzugehen. Hierbei kommen in erster Linie die eisenbahnseitige Beschaffung von Kaffeemaschinen und von Vorrichtungen zur Herstellung von Brausewasser und Brauselimonade in Betracht. Ich verweise in dieser Beziehung auf den Inhalt der Erlasse vom 11. August, 1903 (E. N. Bl., S. 344, 11. September, 1903; E. N. Bl., S. 385, und 26. Januar, 1905, E. N. Bl., S. 45) und mache besonders auf die nachahmenswerte Einrichtung im Direktionsbezirk Cassel aufmerksam, wo Brausewasser auf einer für den Versand günstig gelegenen Station hergestellt und von dort aus an sämtliche Stationen, die solche Einrichtung nicht selbst besitzen, abgegeben wird. Um zu erreichen, dass Kaffee und Brausewasser als Erfrischungsmittel und als Ersatzmittel für alkoholische

Getränke immer mehr begehrt werden, ist es erforderlich, diese Getränke so billig wie möglich abzugeben. Ich erachte ein geringes Hinausgehen im Preise über die möglichst niedrig zu haltenden Herstellungskosten nur da für angezeigt, wo Gemeinschaften von Bediensteten solche Einrichtungen für eigene Rechnung betreiben und die erzielten Ueberschüsse für Wohlfahrtszwecke verwenden. Sodann ist auf allen Stationen, auf denen das Bedürfnis vorliegt, zu den üblichen Tageszeiten kochendes Wasser vorzuhalten und kostenlos abzugeben, damit die Bediensteten sich, falls sie dies vorziehen, ihren Kaffee selbst bereiten können. Auch ist überall für gutes Trinkwasser und für das Vorhandensein einer ausreichenden Anzahl von Zapfstellen zu sorgen, damit möglichst in der Nähe jeder dauernden Arbeitsstelle Trinkwasser leicht zu erreichen ist. Ebenso sind auf geeigneten Stationen Vorkehrungen zu treffen, die die Abgabe von Trinkwasser an das Zugpersonal während des Zugaufenthalts ermöglichen. Damit das Zugpersonal im übrigen darüber unterrichtet ist, auf welchen Stationen eisenbahnseitige Einrichtungen zur Abgabe alkoholfreier Getränke bestehen, empfiehlt es sich, in den Dienstfahrplanbüchern hierüber Vermerke aufzunehmen. Gleichzeitig mache ich es den Eisenbahndirektionen unter Hinweis auf die in meinem Erlasse vom 26. Januar d. J. (E. N. Bl., S. 54) angegebenen Mittel und Wege nochmals zur ernsten Pflicht, Vorkehrungen zu treffen, welche es den Bediensteten, die genötigt sind, die Hauptmahlzeiten ausserhalb ihrer Häuslichkeit einzunehmen, ermöglichen, ein billiges und nahrhaftes Essen auf den Stationen einzunehmen.

Schliesslich verweise ich noch auf die Bestimmungen der Erlasse vom 15. April, 1895 (B. 5429), und vom 10. Oktober d. J. (IV, B. 5, 813) nach denen den Zug- und Rangierpersonalen bei grosser Kälte oder bei ungewöhnlicher Ausdehnung der Fahrzeiten und bei andauernd nasser, kalter Witterung, ferner unter gleichen Voraussetzungen auch den bei der Wiederherstellung unfahrbarer Strecken beschäftigten Bediensteten stärkende Speisen und Getränke für Rechnung der Verwaltung verabreicht werden können und empfehle gleichzeitig, von diesser Ermächtigung stets rechtzeitig Gebrauch zu machen.

Sofern in einzelnen Direktionsbezirken die Ausführung der von mir angeordneten Wohlfahrtseinrichtungen noch nicht genügend weit vorgeschritten sein sollte, erwarte ich nunmehr eine beschleunigte Durchführung. Insoweit dazu die erforderlichen Mittel nicht vorhanden sein sollten, ist für ihre baldige Bereitstellung durch den Etat Sorge zu tragen.

Zum 1. Juli, 1906, sehe ich einem Berichte darüber entgegen, welche Massregeln zur Vorhaltung alkoholfreier Getränke und Beschaffung

warmen Essens für die Bediensteten getroffen worden sind. Die zu Punkt 6 des Erlasses vom 26. Januar d. J. (E. N. Bl., S. 45) angeordnete Berichterstattung erwarte ich zu dem gleichen Zeitpunkte.

An die Königlichen Eisenbahndirektionen.

IV, B. 5., 916.

In einer Verfügung der Eisenbahndirektion Cassel heisst es "Selbstverständlich trifft das Verbot des Alkoholgenusses während des Dienstes auch die sämtlichen höheren Beamten, und gerade von ihnen muss erwartet werden, dass sie den übrigen Bediensteten mit gutem Beispiel vorangehen."

Nach einem weiteren Erlass hält der Minister es für geboten, dass jeder im Betriebsdienst beschäftigte Angestellte, der im Dienste trunken gewesen, in den Anwärterlisten für Beförderungsstellen gestrichen wird. Eine Wiederaufnahme in die Listen würde erst dann in Frage kommen, wenn auf Grund längerer Beobachtung mit Sicherheit angenommen werden könne, dass der Beamte sich ein gleiches Vergehen nicht wieder zu Schulden kommen lassen wird. Hinsichtlich der Anstellung sei eine entsprechende allgemeine Anordnung schon früher getroffen; danach sei bei Beamten, deren Dienstführung zu erheblichen Klagen Anlass gibt, die Uebergehung bei Besetzung etatsmässiger Stellen nicht nur statthaft, sondern geboten, sofern nicht überhaupt die Entlassung in Frage komme. Bei der Verhängung von Disziplinarstrafen gegen Bedienstete, die sich der Trunkenheit schuldig gemacht haben, habe es nach den Beobachtungen des Ministers vielfach an Ernst und Folgerichtigkeit gefehlt. Häufig sei solchen Beamten für den Wiederholungsfall die Dienstentlassung angedroht worden, diese Androhung aber—zumeist mit Rücksicht auf die persönlichen Verhältnisse—trotz des Rückfalles nicht ausgeführt worden. Ein solches Verfahren widerspriche den Erfordernissen der Dienstzucht und der damit zumeist zusammenhängenden Betriebssicherheit. Von der angedrohten Entlassung werde im allgemeinen nur dann abzusehen sein, wenn seit der ersten Verfehlung ein sich über Jahre streckender Zeitraum vergangen sei, innerhalb dessen der Bedienstete sich tadellos geführt habe. Bei den Untersuchungen über Eisenbahnunfälle sei ferner den Einwirkungen des Alkoholgenusses vielfach nicht in ausreichendem Umfange nachgeforscht worden. Ermittelungen seien nach dieser Richtung hin häufig überhaupt nicht angestellt oder auf die Erörterung der Frage beschränkt worden, ob der an einem Unfalle schuldig Beamte zur Zeit des Unfalles betrunken oder angetrunken gewesen sei. Dieser Punkt werde regelmässig klarzustellen und die Ermittelung, soweit angezeigt, auch darauf auszudehnen sein, ob der Beamte infolge gewohnter Unmässigkeit im Alkoholgenuss oder unter der Nachwirkung eines ausnahmsweise starken Alkoholgenusses auch ohne Trunkenheit an seiner kör-

perlichen und geistigen Spannkraft Einbusse erlitten habe. Weiterhin heisst es, die angestrebte Beschränkung des Alkoholgenusses werde an manchen Orten dadurch erschwert, dass sich in unmittelbarer Nähe der Personen-, Güter- und Rangierbahnhöfe eine ausserordentlich grosse Zahl von Gast- und Schankwirtschaften befinde, die durch ihre Lage und durch Anpreisungen verschiedenster Art die Beamten und Arbeiter zum Alkoholgenuss verleiten. Der Minister macht darauf aufmerksam, dass es den Königlichen Eisenbahndirektionen freistehe, auf Grund solcher Uebelstände mit den Ortspolizeibehörden in Verbindung zu treten und diese zu ersuchen, bei Anträgen auf Konzessionserteilung für Gast- und Schankwirtschaften in der Nähe der Bahnhöfe, die ihnen gemäss § 33 der Gewerbeordnung zur gutachtlichen Aeusserung zugehen, auch den Königlichen Eisenbahndirektionen Gelegenheit zu Einwendungen zu geben.

Am 11. August, 1910, erschien eine Zusammenstellung sämtlicher Erlasse, betr. Verpflegung des Personals, die ich des beschränkten Raumes wegen nur erwähnen kann.

Wir fügen noch einige weitere Verfügungen bei.

Lohnzahlung an die Ehefrauen.—Vom preussischen Eisenbahnminister ist neuerdings darauf hingewiesen worden, dass zuweilen die Ehefrauen von Arbeitern den Wunsch haben, den Lohn ihrer Männer selbst abzuheben. Gegen die Erfüllung eines solchen Wunsches wäre nichts einzuwenden, wenn die Eisenbahn-Direktionen mit Arbeitern, die dem Alkoholgenuss ergeben sind, und die der an sie hieran tretenden Versuchung, insbesondere an den Lohnzahlungstagen, nicht zu widerstehen vermöchten, Vereinbarungen träfen, nach denen der Lohn an ihre Ehefrauen oder an andere Beauftragte gezahlt werde. Derartige Vereinbarungen würden nicht nur im Interesse der Arbeiter, sondern auch in dem ihrer Familien liegen, da diese anderenfalls durch die meist unvermeidliche Entlassung ihrer Ernäher aus dem Dienste schwer betroffen würden. Bei entsprechenden Vorhaltungen dürften die beteiligten Arbeiter einer solchen Regelung wohl gern zustimmen; im übrigen empfehle es sich, dass am Löhnungstage beide Eheleute erscheinen, und, während der Ehemann quittiere, die Ehefrau das Geld in Empfang nehme.

Alkoholverbot für den Fall einer Mobilmachung.—Von einer Anzahl Eisenbahnverwaltungen ist angeordnet worden, dass in sämtlichen Bahnhofswirtschaften schon vom ersten Mobilmachungstage an alkoholhaltige Getränke nicht mehr verabreicht werden dürfen. Dagegen sollen alkoholfreie Getränke in genügender Menge bereitgehalten werden, um die geistige und körperliche Leistungsfähigkeit der Mannschaften nicht durch Alkoholgenuss zu beinträchtigen.

Ueber den Erfolg der verschiedenen Erlasse und Massnahmen gibt folgende Notiz Auskunft:

Der dem preussischen Landtage unlängst vorgelegte "Bericht über die Betriebsergebnisse der preussisch-hessischen Staatseisenbahnen im Rechnungsjahr 1910" (Berlin 1912) enthält über die Bekämpfung des Alkoholgenusses der Eisenbahnbediensteten Folgendes:

"Mancherlei Wohlfahrtseinrichtungen haben wesentlich die Durchführung des Verbotes des Genusses alkoholhaltiger Getränke während des Dienstes erleichtert, das im Jahre 1905 für alle im Betriebsdienste, einschliesslich des Fahr-, Rangier- und Bahnbewachungsdienstes beschäftigen Beamten, Hilfsbeamten und Arbeiter, sowie für alle im Stationsschaffner- und Weichenstellerdienste tätigen Bediensteten erlassen ist.

"Nach den in der Zwischenzeit gemachten Erfahrungen hat sich erfreulicherweise gezeigt, dass diese Massregel dazu geführt hat, dass das Personal nicht nur frischer zum Dienst erscheint, sondern auch den Dienst zum Vorteil der Betriebssicherheit mit mehr Ruhe, Ueberlegung und Willigkeit versieht. Auch der Dienstzucht ist sie insofern zustatten gekommen, als Fälle von Widersetzlichkeit gegen Vorgesetzte und Streit unter den Bediensteten selbst seltener geworden sind. Die Zahl der Erkrankungsfälle, die auf Alkoholmissbrauch beruhen, ist zurückgegangen.

"Unter den Bediensteten und gerade den jüngeren, bricht sich immer mehr die Erkenntnis von den Gefahren des Alkoholgenusses Bahn, und von den vorerwähnten Wohlfahrtseinrichtungen wird in immer grosserem Umfange Gebrauch gemacht."

Der Zeitschrift für Bahn- und Bahnkassenärtzte Nr. 5, vom 1. Mai 1910, entnehmen wir die nachfolgende Notiz:

ALKOHOLBEKÄMPFUNG BEI DER EISENBAHN.

Die zur Bekämpfung des Alkoholmissbrauches ergriffenen Massnahmen der preussisch-hessischen Staatsbahnverwaltung sind dadurch erweitert, dass die Verpflichtung der Bahnwirte, an die Stations- und Fahrpersonale Bier zu ermässigten Preisen zu verabfolgen, aufgehoben ist. Wo das Bedürfnis vorliegt, haben die Stationen dafür zu sorgen, dass alkoholfreie Getränke—jetzt Brausewasser—an das Zug- und Lokomotivpersonal während der Zugaufenthalte abgegeben werden können. Als Zugaufenthalte kommen solche von mindestens 4 Minuten in Frage.

Auch ist die Mitwirkung von Mässigkeitsvereinen mit gutem Erfolge in Anspruch genommen und die Unterbringung dem Trunke ergebener Bediensteten in Trinkerheilstätten durch Gewährung von Unterstützung erleichtert worden. Die Bewillingung der Unterstützungen erfolgt bei einzelnen Eisenbahndirektionen unter der Verpflichtung der Bediensteten, nach der Entlassung aus der Heil-

stätte zur Sicherung des Kurerfolges einem Enthaltsamkeitsverein beizutreten, bei andern unter dem Vorbehalt teilweiser Wiedereinziehung.

Die Zahl der wegen Trunkenheit bestraften Bediensteten ist erfreulicher Weise geringer geworden, obwohl seitens der Verwaltung mit unnachsichtiger Strenge vorgegangen wird. Es sind im Direktionsbezirk E im letzten Vierteljahr 13 Angestellte in Ordnungsstrafen genommen und im Jahre 1908 im Direktionsbezirk B 23 Beamte und 81 Hilfsbeamte und Arbeiter mit Ordnungsstrafen, 3 Beamte und 2 Hilfsbeamte mit Zurückziehung aus dem Betriebsdienste und 2 Beamte sowie 16 Hilfsbeamte und Arbeiter mit Dienstentlassung bestraft worden.

An der Spitze aller Direktionen im Kampfe gegen den Alkoholismus marschiert die Generaldirektion der Eisenbahnen in Elsass-Lothringen; dieselbe hat schon frühzeitig Verordnungen gegen den Alkoholgenuss des Personals erlassen, die von einem besonders tiefen sozialen Verständnis Zeugnis geben.

Gegen den Alkoholgenuss der Lokomotivbeamten ist unlängst folgende Verfügung ergangen: "Nüchternheit im Dienst und Mässigkeit ausserhalb desselben sind von jedem Eisenbahnbetriebsbeamten unbedingt zu beobachten." In besonderem Masse gilt dies aber von den Lokomotivbeamten, von deren besonnenem und entschlossenem Handeln die Sicherheit der Züge abhängt. Besonnenheit und Entschlossenheit werden durch Alkoholmissbrauch ausserordentlich beeinträchtigt. Bei der schweren Gefahr die mit einer lässigen Ausübung des Lokomotivfahrdienstes für den Eisenbahnbetrieb verbunden ist, ist streng darauf zu halten, dass alle Lokomotivbeamten sich der Nüchternheit und Mässigkeit befleissigen und dass solche Personen, die zum Trunke neigen, von vornherein von dieser Laufbahn ausgeschlossen oder, wenn sich jene Neigung erst später zeigen sollte, daraus entfernt werden. Wir erwarten dass die Vorstände unserer Werkstätten- und Maschineninspektionen bei der Auswahl der Hilfsheizer aus Werkstättenschlossern und bei deren späterer Beaufsichtigung diesem Gesichtspunkte unausgesetzt die gebührende Aufmerksamkeit zuwenden.

Eine neue Dienstanweisung für das Zugpersonal enthält folgende Vorschrift: "Nüchternheit im Dienst ist für das Zugbegleitungspersonal unbedingtes Erforderniss. Vor Antritt des Dienstes und während desselben ist der Genuss geistiger Getränke zu vermeiden. Unbedingt verboten ist es, Branntwein bei sich zu führen oder während des Dienstes zu geniessen. Beamte, die zum Trunk neigen, sind für den Eisenbahndienst ungeeignet und werden aus ihm entfernt werden."

Aus einer Verfügung der Strassburger Generaldirektion möge nachfolgende Stelle hervorgehoben werden: "Das Verbot des Genusses

alkoholartiger Getränke während des Dienstes wird auf alle Dienstklassen ohne jede Ausnahme ausgedehnt und bezieht sich auf die ganze Dauer des Dienstes und der Dienstbereitschaft. Da die nachteiligen Folgen des Alkoholgenusses stets längere Zeit andauern, so muss verlangt werden, dass das Personal sich ausserhalb des Dienstes der grössten Mässigkeit befleissigt."

Aber, in der sehr richtigen Erkenntniss dass durch Verordnungen und Bestrafungen der Alkoholmissbrauch nicht aus der Welt geschafft wird, hat die Generaldirektion geradezu mustergültige Einrichtungen für die Beschaffung alkoholfreier Getränke getroffen, die ganze Organisation ist vorbildlich. Und das ist das Werk des Geheimen Regierungsrates Ammann, eines Mannes, der seit Jahren mit seltener Umsicht und zielbewusster Tatkraft den Kampf gegen den Alkoholismus in Elsass-Lothringen an erster Stelle leitet.

Nähere Auskunft gibt der nachfolgende Bericht:

DIE REICHSEISENBAHNVERWALTUNG UND DER ALKOHOL.

Zu denjenigen Behörden, die seit langen Jahren einen entschlossenen Kampf gegen den Alkoholismus führen, gehören begreiflicherweise in aller erster Linie die Eisenbahnverwaltungen. Denn es gibt kaum einen Beruf, der in einem solchen Masse einen klaren Kopf und eine feste Hand, ruhige Besonnenheit und schnellen Entschluss erfordert, wie der Eisenbahnbetrieb. Zwar verbessert die Technik ständig die Signal-, Stellwerks- und sonstigen Sicherungseinrichtungen, um jede Betriebsgefahr nach Möglichkeit auszuschliessen, aber alle diese sinnreichen Einrichtungen werden von Menschen bedient und versagen, wenn diese nicht ihre Pflicht tun, weil sie ihrer Aufgabe körperlich oder geistig nicht gewachsen sind. Trotz aller Fortschritte der Technik muss daher das Bestreben der Eisenbahnverwaltung unausgesetzt darauf gerichtet sein, nur solche Beamte und Arbeiter in ihrem Betriebe zu verwenden, die den hohen Anforderungen ihres schweren Berufes in jeder Beziehung in vollem Masse entsprechen und jeden Augenblick im Vollbesitzt ihrer geistigen Spannkraft und körperlichen Tüchtigkeit sind. Zu den schwersten Gefahren, die dem Eisenbahnbetrieb und den der Bahn anvertrauten Menschen und Gütern drohen, gehört daher der Alkoholgenuss der Eisenbahnbediensteten, der ihre Hand lähmt, ihr Auge trübt und ihre Entschlussfähigkeit erschlaffen lässt. In dieser Erkenntnis ist, wie wohl alle deutschen Bahnen, auch die Reichseisenbahnverwaltung von je her dieser Gefahr entgegengetreten und hat in der Heranziehung einer nüchternen, unbedingt zuverlässigen Beamten- und Arbeiterschaft stets eine ihrer vornehmsten Aufgaben erblickt.

Am sichersten wäre es zweifellos gewesen, wenn die Verwaltung, wie dies bei vielen amerikanischen Eisenbahnen bereits der Fall ist,

ihren Betriebsbediensteten völlige Enthaltsamkeit zur Pflicht gemacht und sich dadurch ein abstinentes Personal geschaffen hätte. In der Ueberzeugung indessen, dass eine derartige Forderung mit den zur Zeit in Deutschland noch herrschenden Anschauungen in einem zu schroffen Widerspruch stehen und ihre Durchführbarkeit zweifelhaft sein würde, hat man diese Forderung nicht aufgestellt, sondern sich auf das zunächst Erreichbare beschränkt. Man stellte den Grundsatz auf: "Völlige Nüchternheit im Dienst, strenge Mässigkeit ausserhalb des Dienstes" und suchte ihn mit allen Mitteln durchzuführen. Um von vornherein zu verhindern, dass zum Trunk neigende Personen in den Reichseisenbahndienst aufgenommen würden, machte die Verwaltung den Bahn- und Kassenärzten zur Pflicht, bei der Untersuchung eines Bewerbers sorgfältig festzustellen, ob er nicht etwa zum Alkoholmissbrauch neige, und wies ihn bejahendenfalls unnachsichtlich zurück. Auf die schon im Dienst befindlichen Beamten und Arbeiter wurde in Wort und Schrift, durch Vorträge der Bahnärzte, durch Verteilung von Schriften und Merkblättern von de Terra, Quensel u. a., sowie durch Auslegung alkoholgegnerischer Zeitschriften, belehrend und aufklärend eingewirkt. Beamte und Arbeiter, die sich trotzdem noch der Trunkenheit im Dienst schuldig machten, wurden mit empfindlichen Strafen belegt, in schwereren Fällen entlassen.

Zum Zwecke der Vorbeugung des Alkoholgenusses wurde eine Reihe von Massregeln getroffen. Man stellte geräumige, gut ausgestattete und behagliche Aufenthalts-, Uebernachtungs- und Speiseräume für die Bediensteten des Fahrdienstes her, die ihre Ruhepausen fern von ihrer Heimatstation zu verbringen genötigt sind. In den Aufenthaltsräumen wurden kleine Büchereien mit jährlich wechselndem Bestand eingerichtet, die ernste und leichte Unterhaltung und Belehrung gewähren, so dass der Anreiz zu unnötigen Reden, Kartenspiel und zum Genuss geistiger Getränke erheblich verringert wurde. Hier sind auch die auf vielen Stationen vorhandenen Badeanstalten zu nennen, die den Betriebsbeamten unentgeltlich zur Verfügung stehen und ihnen eine sehr willkommene Erfrischung bieten. Die wertvollste einschlägige Einrichtung aber sind die zahlreichen Ausgabestellen für alkoholfreie Getränke, die die Reichseisenbahnverwaltung seit 1904 ins Leben gerufen hat und ständig vermehrt. Sie haben bei dem Personal in einem unerwarteten Masse Anklang gefunden und werden fleissig benutzt, insbesondere in Zeiten grosser Hitze oder Kälte. Ihnen seien einige Worte gewidmet.

Es bestehen 6 Fabrikationsstellen, und zwar in den Werkstätten in Mühlhausen, Colmar, Bischheim, Montigny, Saargemünd und Luxemburg, wozu im nächsten Jahre noch eine in Diedenhofen kommen wird. In diesen Anlagen wird Mineralwasser (Selterswasser, Zitronen- und Himbeerlimonade) und Kaffee hergestellt, sowie Milch keim-

frei gemacht und an Ort und Stelle ausgegeben. In der Frühstücks- und Vesperpause erscheinen die Arbeiter an den Schaltern und versorgen sich mit den Getränken, die sie dann, mit dem mitgebrachten Frühstück an ihrer Arbeitsstelle zu sich nehmen.

Der Preis der Getränke entspricht den Selbstkosten, die, da die Verwaltung die Räume und Maschinen stellt und die allgemeine Verwaltung und Beaufsichtigung besorgt, lediglich in den Kosten der Materialien und Unterhaltung, sowie in den Löhnen bestehen. Infolge dieses Umstandes kosten eine Portion (=4/10 Liter) Kaffee, 1 Portion (=1/20 Liter) Milch, eine Düte Zucker (5 Stück) oder eine Flasche Selterswasser nur 2 Pfg., eine Flasche Limonade 7 Pfg. Ein Arbeiter, der, wie dies leider nicht selten vorkommt, morgens zu Hause kein Frühstück erhält, kann sich dies nunmehr billig verschaffen, indem er auf dem Weg zur Arbeit beim Bäcker Brot kauft und sich in der Getränkeausgabe für 6 Pfg. Milch, Kaffee und Zucker geben lässt.

Von den 6 Hauptausgaben werden die Getränke an die im ganzen Bahngebiet zerstreuten Unterausgaben versandt, deren es zur Zeit 30 gibt, z. B. auf dem Bahnhof zu Colmar, und die in besonderen Räumen eingerichtet und von einem eigens hierfür bestellten Bediensteten (meist einem Pensionär oder Unfallrentner) verwaltet werden. Sie sind mit einem Herd oder einem Kochapparat, vielfach auch mit Maggi-Apparaten versehen und man kann bei manchen auch einen Imbiss erhalten, sodass sie sich zu kleinen Kantinen entwickelt haben.

Ausserdem bestehen noch 120 kleinere Ausgaben, sogenannte Zweigstellen, bei denen im Sommer Mineralwasser abgegeben wird, das sie von den Unterausgaben beziehen.

Der Umfang, in welchem die Eisenbahner von diesen Einrichtungen Gebrauch machen, ist aus folgender Uebersicht zu ersehen.

Es sind folgende Portionen Getränke und Zucker abgegeben worden:

	Kaffee.	Selters-wasser.	Limonade.	Milch.	Suppen-würfel.	Zucker.
1904	333,785	135,591	117,168	.....	.....	86,225
1905	612,843	373,856	414,968	315,936	.....	198,646
1906	1,111,891	483,024	515,349	274,970	237,500	465,412
1907	1,174,615	475,715	645,100	365,980	224,400	588,365
1908	1,119,220	829,995	1,031,295	474,640	149,500	560,485
1909	1,183,475	580,705	872,925	679,090	232,100	596,705
	5,535,829	2,878,886	3,596,805	2,110,616	843,500	2,495,838
			14,205,486			

Der Umsatz betrug:

	M.		M.
1904	18,142.10	1908	123,059.50
1905	54.923.70	1909	115,496.00
1906	80,001.88		
1907	93,043.50	Insgesamt	484,666.68

Also in 6 Jahren über 14 Millionen Portionen alkoholfreie Getränke für rund ¾ Million Mark! Gewiss ein schöner Erfolg und man wird einem erfahrenen Kenner des Eisenbahnwesens, dem Strassburger Bahnarzt, Geheimrat Dr. Ullersperger, nur zustimmen können, wenn er in einem vor seinen Kollegen gehaltenen Vortrage (Zeitschrift für Bahn- und Kassenärzte, 1907, Nr. 10) sagt: "Wer sich diese Zahlen vergegenwärtigt und vergeistigt, wird ermessen können, wieviel Segen darin enthalten ist, wieviel Flaschen Bier und Wein und wieviel Schnäpse weniger getrunken worden sind, wieviel Jammer erspart, wieviel Herzensfreude und heiterer Sinn damit geschaffen worden und erhalten worden ist, wieviel Mark im Beutel dem Einzelnen und der Familie erhalten geblieben, wieviel Arbeit mehr der Verwaltung geleistet und wieviel Unfälle und wieviel Krankheiten im Betriebe vermieden worden sind."

Einen ganz besonderen Wert hat diese Wohlfahrtseinrichtung erlangt, seit der frühere Chef der Reichseisenbahnverwaltung, der preussische Staatsminister Herr von Budde, unter dem Eindruck verschiedener Vorkommnisse, insbesondere des unheilvollen Spremberger Eisenbahnunglückes vom 7. August 1905 den bekannten Alkoholerlass vom 20. November 1905 ergehen liess, in welchem den im Betrieb beschäftigten Beamten und Arbeitern jeder Genuss alkoholischer Getränke im Dienst streng verboten und Trunkenheit im Dienst mit schwerer Strafe, bei Wiederholung mit Entlassung bedroht wurde. Die Durchführung dieses Verbotes wurde dort erheblich erleichtert, wo, wie im Reichsland, eine ausreichende Gelegenheit für die Bediensteten bestand, sich mit erfrischenden oder erwärmenden Ersatzgetränken zu versorgen. Hier konnte nicht die Ausrede gebraucht werden, man habe mangels alkoholfreier Getränke notgedrungen zum Bier u. s. w. greifen müssen. Im Hinblick auf das Bestehen der Getränkeausgaben trug die Generaldirektion in Strassburg denn auch keine Bedenken, das Verbot auch die nicht im Betrieb verwendeten Beamten und Arbeiter auszudehnen, eine Massregel, die unliebsame Vergleiche unter den verschiedenen Klassen der Eisenbahner ausschloss und dem Verbot seinen Stachel zum guten Teil nahm.

Schliesslich sei noch erwähnt, dass die Verwaltung ihren Bediensteten den Anschluss an die verschiedenen alkoholgegnerischen Vereine, z. B. den Eisenbahn-Alkoholgegnerverband (Vorsitzender: Bahnarzt Dr. Gaye in Stettin), den deutschen Verein gegen den Missbrauch geistiger Getränke und die reichsländischen Enthaltsamkeitsvereine dringend empfohlen und sie auf die einschlägigen Zeitschriften, z. B., Das Volkswohl, hingewiesen hat.

Im Hinblick auf alle diese Massnahmen darf gehofft werden, dass die Reichseisenbahnverwaltung ihrem Ziele, den Gefahrbringer Alkohol in ihrem Getriebe völlig unschädlich zu machen, immer näher

kommt und die Betriebssicherheit in gleichem Masse eine ständige Zunahme erfährt.

Und was ist erreicht? Im Jahre 1909 teilte die Eisenbahndirektion in Strassburg mit, dass die Durchführung des Alkoholverbotes in ihrem Geschäftsbereich folgendes Ergebnis gezeitigt hätte:

1. Das Personal erscheint frischer zum Dienst, ist grösseren Anforderungen gewachsen und führt den Dienst zum Vorteil der Betriebssicherheit mit mehr Ruhe, Ueberlegung und Willigkeit durch.

2. Die Disziplin hat sich insofern gehoben, als Widersetzlichkeiten gegen Vorgesetzte und Streitereien unter den Bediensteten seltener geworden sind.

3. Die Zahl der Erkrankungen, die auf Alkoholmissbrauch geruhen, ist zurückgegangen.

Für die Erkenntnis des tatsächlichen Umfanges, in welchem der Alkoholismus die Häufigkeit von Betriebsunfällen beeinflusst, fehlt es noch an völlig einwandsfreien und ausreichenden statistischen Unterlagen. Wenn auch mit Einführung des Alkoholverbotes im Gebiete der Reichseisenbahnen die Anzahl der Unfälle von 153 im Jahre 1905 auf 124 (1906) sowie die Anzahl der Getöteten (1905, 37) und verletzten Bediensteten (1905, 50) auf 31 bezw. 48 im Jahre 1906 gesunken ist, so können hieraus doch nicht die Schlüsse gezogen werden, die aus sonstigen Statistiken so überzeugend den Einfluss des Alkohols auf anderen Gebieten erkennen lassen.

Von der badischen Generaldirektion ist folgender Erlass ergangen:

A. Um Gefährdungen der Betriebssicherheit durch Alkoholmissbrauch des Personals zu verhüten, sind von der Generaldirektion der badischen Staatsbahnen folgende Vorschriften erlassen:

1. Die gemeinsamen Bestimmungen für die badischen Staatseisenbahnbeamten verbieten den Genuss geistiger Getränke auf den Geschäftszimmern sowie den Besuch von Wirtschaften während des Dienstes.

2. Dem Fahrpersonal (Zugbegleitungs- und Zugbeförderungspersonal) ist der Besuch von Wirtschaften auf den Zwischenstationen, sofern eine Erfrischung überhaupt nötig erscheint, nur bei einem Aufenthalt von mehr als einer halben Stunde und nur mit Zustimmung des Stationsvorstandes oder seines Stellvertreters gestattet.

3. Das Fahrpersonal darf, solange es sich im Dienste am Zug oder auf der Lokomotive befindet, keine geistigen Getränke zu sich nehmen. Das Mitführen derartiger Getränke im Dienste ist allgemein untersagt.

4. Für die im Betriebsdienst beschäftigten Arbeiter und die der Arbeitsordnung für die Werkstätten unterliegenden Werkstättenarbeiter besteht die Vorschrift, dass der Genuss geistiger Getränke nur während der Arbeitspausen gestattet ist und sich auf das für die Erhaltung der Arbeitskraft zulässige Masse zu beschränken hat.

Unbedingt verboten ist das Mitbringen und der Genuss von Branntwein.

5. Dem niederen Dienstpersonal ist vorgeschrieben, sich vor Dienstantritt beim nächsten Vorgesetzten zum Dienste zu melden. Dadurch ist dem Vorgesetzten Gelegenheit geboten, das unterstellte Personal zu beobachten und zu prüfen, ob es dienstfähig ist. Es ist streng verpflichtet, etwa wahrgenommene Ungehörigkeiten zu verfolgen und Personal, das ihm nicht dienstfähig erscheint, vom Dienste fernzuhalten.

6. Jeder Eisenbahnbedienstete, der bemerkt, dass ein anderer Eisenbahnbediensteter, der im äusseren Dienst, insbesondere im Zugbeförderungs- oder im Zugbegleitungsdienst tätig oder einen solchen anzutreten im Begriffe ist, betrunken oder auch nur angetrunken ist, hat die Verpflichtung, seine Beobachtung unverzüglich dem nächsterreichbaren Vorgesetzten zu melden; die Unterlassung der Anzeige ist strafbar.

B. Um den Genuss alkoholischer Getränke beim Eisenbahnpersonal möglichst einzuschränken, hat die badische Eisenbahnverwaltung in den letzten Jahren verschiedene Einrichtungen getroffen. Unter diesen sind in erster Reihe die Eisenbahnkantinen zu nennen, die auf einigen grösseren Stationen eingerichtet worden sind. Der Hauptzwek dieser Kantinen besteht darin, dem Eisenbahnpersonal zu billigen Preisen kalte und warme Speisen, sowie alkoholfreie Getränke, wie Kaffee, Tee, verschiedene Mineralwasser und Limonaden zu liefern. Daneben wird in einigen Kantinen auch Bier und Wein, jedoch nicht gleich den alkoholfreien Getränken zu ermässigten Preisen verabreicht. Die Kantinenverwalter, die an dem Verkauf der Getränke keinen Nutzen haben, haben dafür zu sorgen, dass alkoholhaltige Getränke nicht im Uebermass genossen werden. Kantinen, in denen ausser alkoholfreien Getränken auch Bier und Wein abgegeben wird, bestehen zur Zeit in Mannheim, Karlsruhe, Offenburg, Freiburg, und Basel; solche, die nur alkoholfreie Getränke abgeben, in Heidelberg und Bruchsal. Die Einrichtung weiterer alkoholfreier Kantinen steht bevor.

Die Eisenbahnkantine in Heidelberg, bei der Einrichtungen zur Herstellung von Sodawasser und Limonaden in grösserem Umfange bestehen, ist neuerdings ermächtigt worden, ihre Erzeugnisse zum Selbstkostenpreise auch an andere Stationen zu versenden, um auch den Beamten und Arbeitern der Stationen, auf denen Kantinen nicht bestehen, die Möglichkeit zu geben, ein erfrischendes, aus den besten Stoffen sorgfältig hergestelltes Getränk zu billigen Preisen zu erhalten. Verwaltungsseitig ist die Beförderung der Getränke als Dienstgut ohne Frachtberechnung zugestanden. Soviel sich bis jetzt

beurteilen lässt, wird von dieser Einrichtung die allmählich über das ganze Land ausgedehnt werden soll, ausgiebig Gebrauch gemacht werden.

An Orten, an denen keine Eisenbahnkantinen bestehen, sind die Bahnhofswirte verpflichtet, dem Eisenbahnpersonal kalte und warme Speisen sowie alkoholfreie Getränke zu Ausnahmepreisen zu verabreichen.

Seit Jahresfrist wird dem in anstrengendem Dienst beschäftigten Personal aller Dienstzweige bei Kälte oder Hitze warmer Kaffee auf Kosten der Verwaltung verabreicht.

Bei Bahnhofs-, Neu- und Umbauten werden Aufenthalts- und Uebernachtungsräume mit Wasch- und Badeeinrichtungen nach den neuesten Erfahrungen vorgesehen. Die vorhandenen Räume werden, soweit es die örtlichen Verhältnisse gestatten, immer wohnlicher eingerichtet, um das Personal möglichst vom Besuch der Wirtshäuser abzuhalten.

Auch durch Belehrung und Aufklärung über die schädlichen Wirkungen und nachteiligen Folgen des Alkoholmissbrauches wird auf das Personal einzuwirken gesucht. Zu diesem Zwecke sind verschiedene belehrende Schriften in den Aufenthalts- und Uebernachtungsräumen des Personals aufgelegt oder dem Personal ausgehändigt.

Der bisherige Erfolg aller dieser Massnahmen berechtigt zu den besten Hoffnungen für die Zukunft.

Die badische Staatsbahnverwaltung hat auf einer Reihe von Stationen, auch in entlegenen Rangier- und Werkstättenbahnhöfen Kantinen eingerichtet, in denen das Personal zu billigem Preise alkoholfreie Getränke, wie Kaffee, Tee, Milch, verschiedene Mineralwasser und Limonaden, sowie warme und kalte Speisen erhalten kann. Während von einem Teil dieser Kantinen, hauptsächlich den älteren (8), auch noch Bier und Wein verabfolgt wird, fähren die in neuerer Zeit errichteten (68) nur alkoholfreie Getränke. In den grösseren Kantinen wird grosser Wert auf die Abgabe eines kräftigen und billigen warmen Mittagessens gelegt. Mit einem Teile der Kantinen sind Einrichtungen zur Herstellung von Sodawasser und Limonaden verbunden. Während vor Einrichtung der Kantinen vom Eisenbahnpersonal Sodawasser und Limonaden in irgend nennenswerten Mengen überhaupt nicht genossen wurden, haben diese sieben Anstalten im Jahre 1908 im ganzen 734,846 Flaschen Sodawasser und 973,616 Flaschen Limonade, im ganzen also nahezu 1¼ Millionen Flaschen alkoholfreie Getränke hergestellt, die zu sehr billigem Preise, zum Teil an den Herstellungsorten selbst verbraucht, zum Teil nach anderen Stationen versandt wurden. An Orten, an denen keine Dienstkantinen bestehen, sind die Bahnhofswirte verpflichtet,

dem Eisenbahnpersonal alkoholfreie Getränke, insbesondere Kaffee, Milch und Sodawasser, sowie kalte und warme Speisen, von der Eisenbahnverwaltung genehmigten Ausnahmepreisen, zu verabfolgen.

In der Kantine des Güterbahnhofes Heidelberg wurden von Oktober 1905 bis Ende September 1906 abgegeben:

	Flaschen.
Kaffee, à 6 Pfg	53,776
Milch, à 8 Pfg	15,948
Brausewasser, à 3 Pfg	66,897
Limonade, à 6 Pfg	134,421

Sehr energisch ist der Kampf gegen den Alkoholismus in Bayern von dem früheren Verkehrsminister, Herrn v. Frauendorfer, aufgenommen, welcher bei der Beratung des bayrischen Eisenbahnetats in der Abgeordnetenkammer auf die Bemerkung eines Abgeordneten "er habe noch keinen bayrischen Lokomotivführer gesehen, dem ein Mass Bier geschadet hat," die Antwort gab: "Ein Mass Bier wird einem Lokomotivführer nichts schaden, aber ich möchte doch wünschen, dass die Abstinenzbewegung bei den Bediensteten mehr Anklang fände."

Auch der jetzige Verkehrsminister, Exz. Ritter v. Seidlein, hat sowohl früher als auch jetzt stets ein sehr tiefgehendes Verständnis für diese Frage gezeigt, und alle, auf die Bekämpfung des Alkoholismus zielenden Bestrebungen tatkräftig unterstützt.

Den Haupterlass vom. 24. April, 1906, bringen wir wörtlich, weil er eben ganz besonders wichtig ist.

Sonderabdruck Nr. 30 aus dem Amtsblatte der Königl. Bayrischen Staatseisenbahnverwaltung Nr. 21 für die Generaliensammlungen. (Pers. Gr. 1, 14, 19, 20, 25, 26a, 27a, u. 28–31.)

Nr. 115. Massnahmen zur Einschränkung des Alkoholgenusses bei dem Eisenbahnpersonal. (Nr. 1247, I.)
(V. M. Nr. 1077, VII.) A., a. Nr. 12.

An die der Generaldirektion unmittelbar untergeordneten Dienststellen:

I.

Die Staatseisenbahnverwaltung hat bei dem Bestreben, den Alkoholgenuss unter ihrem Personale einzuschränken, nicht nur die Betriebssicherheit, sondern auch die Fürsorge für das Personal im Auge.

Dabei wird ein besonderer Erfolg von Massnahmen erwartet, welche sich auf das Gebiet der Belehrung und Vorbeugung erstrecken und die äusseren Umstände beseitigen oder in ihrer Wirkung abschwächen, die den Alkoholgenuss unter dem Eisenbahnpersonale zu fördern geeignet sind.

Die in dieser Richtung schon seither erlassenen Bestimmungen werden im nachstehenden zusammengefasst ergänzt:

A. MASSNAHMEN ZUR AUFKLÄRUNG DES PERSONALS IN DER ALKOHOLFRAGE.

1. Ein Hauptgewicht ist auf die Belehrung des Personals über die gesundheitlichen, sittlichen und wirtschaftlichen Schäden des übermässigen Alkoholgenusses zu legen, da das Verständnis des Personals für die auf Einschränkung des Alkoholgenusses gerichteten Bestrebungen die Voraussetzung für ein gedeihliches Wirken der behördlichen Anordnungen und Einrichtungen ist.

2. Zu den Aufgaben der Bahnärzte gehört es, das Personal gelegentlich der Krankenbehandlung und durch zeitweilige Vorträge, etwa im Anschlusse an den Unterricht in der ersten Hilfeleistung bei Unglücksfällen, über zweckmässige Ernährung, über den wahren Wert des Alkohols als Nahrungsmittel, sowie über die gesundheitsschädlichen Folgen übermässigen Alkoholgenusses aufzuklären. Zu diesen Vorträgen kann auch den Frauen der Bediensteten der Zutritt gestattet werden.

3. Sache der Vorgesetzten ist es, auf ihre Untergebenen nicht nur durch gutes Beispiel, sondern auch durch sachgemässe Ratschläge über zweckmässige, dem Dienste angepasste Lebenshaltung einzuwirken, besonders bei der Einführung der Untergebenen in den Dienst.

4. In den Uebernachtungs- und Unterkunftsräumen des Personals und an sonst geeigneten Orten sind auch weiterhin Schriften gegen den Alkoholmissbrauch, bildliche Darstellungen u. s. w. aufzulegen oder in Plakatform auszuhängen. Auf Wunsch sind den Bahnärzten solche Schriften zur Auflage in den Wartezimmern zur Verfügung zu stellen (vgl. ABBV 1903/93, betr. die Auflage der Schrift: "Was sollst du von Bier und Branntwein wissen?" und ABBBV 1903/420, betr. die Verbreitung des im Kaiserlichen Gesundheitsamte bearbeiteten "Alkohol-Merkblattes").

Ausser den bereits hinausgegebenen Schriften können die Dr. Grotjahn'sche Schrift "Soll man bei der Arbeit Alkohol geniessen?" und der Aufsatz von de Terra "Alkohol und Eisenbahndienst" sowie die Sammlung von Vorträgen über die Alkoholfrage von Otto Koch vom Materialdepot der Generaldirektion bezogen werden.

5. Die Bestrebungen der Mässigkeits- und Enthaltsamkeitsvereine sind tunlichst zu unterstützen, besonders jene des Deutschen Vereines enthaltsamer Eisenbahner durch Ueberlassung bahneigener Lokale für Vorträge, durch Bezug und Verbreitung der Zeitschrift "Der enthaltsame Eisenbahner" u. a. (G. D. E. vom 28. März 1902, Nr. 21627, I, und ABV 1902/444).

B. MASSNAHMEN ZUR VERHÜTUNG DES ÜBERMÄSSIGEN UND DES UNZEITIGEN GENUSSES GEISTIGER GETRÄNKE.

Das Festhalten des Personals am Biergenusse wird zum Teil auf die verhältnismässig hohen Preise der alkoholfreien Ersatzgetränke zurückzuführen sein, sowie darauf, dass alkoholhaltige Getränke überhaupt vielfach ohne eigentliches Bedürfnis eingenommen werden, wenn das Personal darauf angewiesen ist, seine regelmässigen Mahlzeiten in Bahnhofs- und Orts-Wirtschaften zu sich zu nehmen.

Dem Personale ist daher möglichst Gelegenheit zu geben, sich anderweitig mit Speisen und alkoholfreien Getränken zu erquicken.

Hierzu werden nachstehende Vorkehrungen dienen:

1. BEREITSTELLUNG VON TRINKWASSER.

Vor allem ist dafür zu sorgen, dass dem Personal auf den Bahnsteigen oder in deren unmittelbarer Nähe, sowie in den Unterkunfts- und Uebernachtungsräumen gutes Trinkwasser zur Verfügung steht. Nötigenfalls ist durch Wegweiser auf vorhandene Brunnen aufmerksam zu machen.

In den grösseren Rangier- und Güterbahnhöfen sowie in den grösseren Werkstätten ist die Errichtung von leicht zugänglichen Trinkwasserbrunnen angezeigt.

2. BEREITSTELLUNG VON ALKOHOLFREIEN ERSATZGETRÄNKEN IN DEN BAHNHOFSWIRTSCHAFTEN.

An den Stationen, wo die Züge Aufenthalt nehmen und sich erfahrungsgemäss das Bedürfnis nach erfrischenden und belebenden Getränken geltend macht, sind die Bahnhofswirte anzuhalten, in den Restaurationsräumen, an den Büfetts und an den Zügen auch für das Zugpersonal, insbesondere auch für jenes der Güterzüge, warme und alkoholfreie Getränke zu jeder Tages- und Jahreszeit bereitzustellen und frisches Trinkwasser unentgeltlich abzugeben.

Bei Vereinbarungen mit den Bahnhofwirten bezüglich der Verabreichung von Speisen und Getränken an das Personal zu ermässigten Preisen (nach einem Sondertarife, der dem Personale durch Anschlag an geeignetem Orte zugänglich sein muss) ist auch darauf hinzuwirken, dass alkoholfreie Getränke von guter Beschaffenheit, in entsprechender Menge (z. B. eine ungefähr ein Quart haltende Tasse Kaffee oder Tee mit Milch) soweit möglich, nicht teurer als $\frac{1}{2}$ Liter Bier, abgegeben werden.

Die Stationsvorstände sowie die Kontrollbeamten der Eisenbahnbetriebsdirektionen haben sich von Zeit zu Zeit persönlich sowie durch Umfrage unter dem Personale zu vergewissern, ob die Bediensteten in den Bahnhofwirtschaften Speisen und alkoholfreie Getränke

in entsprechender Güte und Menge zu den vereinbarten Preisen erhalten können.

3. ERMÖGLICHUNG, SPEISEN UND GETRÄNKE ZUZUBEREITEN ODER AUFZUWÄRMEN.

(a) Das Maschinenpersonal soll sich mitgebrachte Speisen und Getränke auf der Maschine erwärmen können. Dies wird durch Anbringen von Wärmeplatten oder durch Ausschnitte in der Kesselbekleidung, die ein sicheres Aufstellen der Gefässe gestatten, erleichert.

(b) Um dem Schaffnerpersonale zur kalten Jahreszeit zu ermöglichen, sich Speisen und Getränke während des Dienstes zuzubereiten oder aufzuwärmen, werden die Heizkörper der in Schnell- und Personenzügen laufenden Dienstwagen zweckmässig gestaltet und die Füllöfen der Dienst- und Packwagen der Güterzüge mit geeigneten Vorrichtungen (Wärmeplatten mit Sicherung für die aufgesetzten Gefässe) versehen.

Dem Personale ist das Mitführen von Kochkisten (Selbstkochern) zu empfehlen; deren Einführung ist vor allem dadurch zu fördern, dass bei Vorträgen der Bahn- und Kassenärzte über die Verpflegungsfrage auf die Vorteile solcher Kisten hingewiesen wird und sie im Gebrauche vorgeführt werden.

(c) In den Werkstätten mit Dampfmaschinen werden sich unschwer Wärmetische oder Wärmekisten aufstellen lassen.

(d) Auch für die Wärterbuden, Diensträume etc. sind die Oefen von einer Form, welche das Erwärmen von Speisen und Getränken gestatten, auszuwählen.

Bei Vornahme grösserer Bahn-, Bau- und Unterhaltungsarbeiten sind Unterstandshütten (Wellblechbuden) mit Kocheinrichtung aufzustellen.

Die bei Bahnunterhaltungsarbeiten an der Strecke tätigen und die Arbeitsstätten häufig wechselnden Arbeiterpartien sind mit Schutzzelten und tragbaren Kochöfen auszurüsten, wie dies bereits in grösserem Umfange geschehen ist.

Für einzelne Streckenarbeiter wird sich das Mitführen von Speisen in sogenannten Selbstkochern oder Kochkisten empfehlen.

(e) Die Tilfs- und Gerätschaftswagen sind mit Kocheinrichtungen, sowie mit Suppen-, und Kaffeekonserven und dem erforderlichen Geschirre auszurüsten.

4. EINRICHTUNG DER UEBERNACHTUNGSLOKALE UND UNTERKUNFTSRÄUME.

Fortgesetzt ist darauf Bedacht zu nehmen, die Uebernachtungslokale im Sinne der ABV 1901/364 wohnlich auszugestalten und ins-

besondere mit Kochherden oder mit Gaskochern zu versehen. Der Betrieb der Uebernachtungsräume ist unter Beachtung der ABV 1905/72 mit grösster Aufmerksamkeit zu überwachen. In den Uebernachtungslokalen ist belehrende und unterhaltende Lektüre aufzulegen. (G. D. E. vom 18 August 1901, Nr. 59194.)

Ausserdem werden zunächst versuchsweise in einzelnen grösseren Uebernachtungslokalen, in stark besuchten Aufenthaltsräumen des Personals oder sonst geeigneten Orten Automaten angebracht werden, welche gegen Einwurf eines Geldstückes Suppenkonserven, Tee oder Kaffee in Einzelportionen zur Selbstherstellung warmer Getränke entnommen werden können. (G. D. E. vom 4. April 1906, Nr. 4283 I/V. M. Nr. 3108 VII.)

In den grösseren Stationen sollen wohnlich ausgestattete Aufenthalts- und Unterkunftsräume mit Kochgelegenheit bereitgestellt werden. Wo solche Räume schwer zu beschaffen sind, kann die Aufstellung von Wellblechbuden mit Heizvorrichtung zweckmässig sein.

5. MINERALWASSERANSTALTEN UND KAFFEEKÜCHE.

In den Zentralwerkstätten, sowie in den grossen Rangier- und Güterbahnhöfen werden nach Bedarf Mineralwasseranstalten und Kaffeeküchen, unter Umständen förmliche Kantinen, in welchen jedoch alkoholhaltige Getränke nicht verabreicht werden dürfen, eingerichtet, sodass insbesondere auch dem Rangier- und Wechselwärterpersonale der grossen Rangierbahnhöfe bei ununterbrochener Dienstzeit von mindestens 8 Stunden, zumal während der Nacht, in der kalten Jahreszeit warmer Kaffee oder Tee, in der warmen Jahreszeit aber kühlende Getränke (kohlensaures Wasser, Limonaden, kalter Tee) zu einem sehr billigen Preise verabreicht werden kann.

Allgemeine Anordnungen zur Sache sind neuestens in der Ministerial-Entschliessung vom 27. Dezember 1905, Nr. 5176, VII/GD, Nr. 75550 erlassen worden.

Es ist darauf Bedacht zu nehmen, bei Neuanlagen an grösseren Dienstorten die Herstellung tunlichst zu zentralisieren und von solchen Punkten aus den Bedarf der kleineren Dienstellen des Bezirkes mit zu decken.

Der Betrieb der Einrichtungen wird grundsätzlich von der Staatseisenbahnverwaltung in Regie geführt, insbesondere werden auch die Apparate zur Herstellung von Mineralwasser und Limonaden die Kaffeemaschinen, sowie die zum Betriebe erforderlichen Materialien etc. vorschussweise beschafft; auch die Ausgaben für Bedienung der Einrichtungen, die tunlichst an Unfallrentner, Pensionisten oder an Witwen von Bediensteten und Arbeitern zu übertragen ist, werden vorschussweise von der Staatseisenbahnverwaltung bestritten.

Diese Aufwendungen sind aus den Erträgnissen der Einrichtungen wieder zu ersetzen. Soweit hiernach noch Ueberschüsse verbleiben,

sind sie zu Wohlfahrtseinrichtungen für das Personal zu verwenden. (ABV 1905/331.)

Wenn für Einrichtungen, die zur Bereitung alkoholfreier Getränke für das Personal dienen, Arbeiten in den Werkstätten ausgeführt werden, so ist bei den Kostenberechnungen ein Zuschlag für allgemeine Unkosten nicht in Ansatz zu bringen. (ABV 1905/407.)

II.

1. Nach vorstehenden Gesichtspunkten ist darauf Bedacht zu nehmen, zur Bekämpfung des Alkoholmissbrauches bei dem unterstellten Personale die nach Ort und Zeit zweckmässig erscheinenden Massregeln in eigener Zuständigkeit zu treffen oder zu beantragen, sobald sich hierzu die Gelegenheit bietet. Die unter Abschnitt I B bezeichneten Massnahmen sind aber nicht mit einem Male, sondern nur schrittweise nach Massgabe der verfügbaren Mittel und entsprechend der wachsenden Anteil nachmal des Personals an der Beseitigung des Alkoholmissbrauches durchzuführen. Sachdienliche Vorschläge von allgemeiner Bedeutung können jederzeit bei der Generaldirektion angebracht werden.

Bei den geplanten Einrichtungen und Versuchen sind die Wünsche der Bediensteten und Arbeiter (Arbeiterausschüsse) nach Möglichkeit zu berücksichtigen.

2. Für den Betriebsdienst werden beschränkende Anordnungen über den Genuss alkoholhaltiger Getränke erlassen werden. Ohne Rüchsicht hierauf sind aber im Interesse der Fahrsicherheit schon jetzt etwaige Missstände hinsichtlich des Genusses alkoholhaltiger Getränke im Dienste unbedingt zu beseitigen.

Von einigen anderen Erlassen können nur Auszüge gebracht werden:

Im Anschluss an die kürzlich herausgegebene Zusammenstellung der Massnahmen, die zur Einschränkung des Alkoholgenusses beim Eisenbahnpersonal bestimmt sind (Vergl. Nr. 8, S. 8), hat die Generaldirektion der bayrischen Staatsbahnen neuerdings zur Vermeidung von Gefährdungen der Betriebssicherheit durch Alkoholmissbrauch für das im eigentlichen Betriebsdienst tätige Personal sowie für das Personal des Wagenaufsichtsdienstes besondere Vorschriften erlassen. Von diesem Personal muss nicht nur gefordert werden, so heiss es dort, dass durch den Alkoholgenuss ausser Dienst und während längerer Dienstpausen die Dienstfähigkeit in keiner Weise beeinträchtigt wird, sondern auch, dass während des Dienstes und in kürzeren Dienstpausen der Alkoholgenuss überhaupt unterbleibt. Ein massiger Alkoholgenuss—mit grundsätzlichem Ausschluss von Branntwein—ist daher nur in Arbeitspausen von mindestens einer halben Stunde gestattet, sodass das Getränk nicht rasch und hastig

eingenommen werden muss. Ausdrücklich verboten wird, alkoholhaltige Getränke für das Fahrpersonal zum Genuss während der Fahrt an den Zug zu bringen. Der Genuss alkoholfreier Getränke ist jederzeit gestattet.

Alle Vorgesetzten haben besonders auf den nüchternen Zustand des gesamten Personals zu achten und Angetrunkene unter allen Umständen vom Dienst zurückzuweisen. Beim Dienstwechsel darf kein Abzulösender dem Ablöser den Dienst übergeben, wenn dieser nicht vollständig dienstfähig und nüchtern ist. Auch sonst hat das Personal zur Vermeidung von Gefährdungen der Fahrsicherheit sofort die nächsten Vorgesetzten auf angetrunkene Dienstleistende aufmerksam zu machen. Bei Verstössen hiergegen ist mit aller Schärfe vorzugehen, insbesondere ist je nach Lage des Falles ausser den eigentlichen Disziplinarstrafen die Ausschliessung von der Anstellung, von Gehaltszulagen und von der Beförderung ins Auge zu fassen. Abgesehen hiervon ist jeder, der im Dienst betrunken angetroffen wird, zum mindesten von der weiteren Verwendung im Betriebsdienst solange aus zu sich liessen, bis auf Grund längerer Beobachtung angenommen werden kann, dass er sich eines gleichen Vergehens nicht wieder schuldig machen wird.

Die Ermittelungen über Eisenbahnunfälle sind regelmässig darauf auszudehnen, ob die Schuldigen angetrunken waren oder ob sie auch ohne Trunkenheit infolge gewohnter oder ausnahmsweiser Unmässigkeit im Alkoholgenuss an ihrer körperlichen und geistigen Spannkraft Einbusse erlitten haben.

Das Verbot, alkoholhaltige Getränke für das Fahrpersonal zur Einnahme während der Fahrt an den Zug zu bringen, wird nicht mit der nötigen Strenge durchgeführt. Ich bringe daher dieses Verbot in Erinnerung und beauftrage die Vorstände der Dienststellen, denen Fahrpersonal zugeteilt ist, dieses durch geeignete Belehrung auf die Bedeutung der angeführten Anordnung für die Sicherheit des Betriebs und auf die bei Verfehlungen gegen diese Anordnung zu gewärtigenden Dienststrafen und Massregelungen nachdrücklich hinzuweisen. Von den Inspektions- und Kontrollbeamten, dann von den Vorständen und Aufsichtsbeamten der Bahnstationen erwarte ich, dass sie pflichtgemäss Fahrbeamte, die sich gegen das Gebot verfehlen, zur Rechenschaft ziehen und ihren vorgesetzten Dienststellen anzeigen.

Ein ganz hervorragendes Verdienst an der Bekämpfung des Alkoholismus haben Hofrat Dr. Stich-Nürnberg, welcher auf der Bahnärzteversammlung in Metz 1904 einen Vortrag hielt über "Die Ernährung des Eisenbahnpersonals während der Fahrt" sowie ganz besonders der Oberbahnarzt Med. Rat Dr. Zeitlmann, München. Einem Vortrage desselben "Massnahmen und Einrichtungen der K. B. Staatseisenbahnverwaltung zur Verpflegung des Personals und zur

Einschränkung des Alkoholgenusses sind die nachfolgenden Daten entnommen:

Die Bahnärzte haben sich bemüht, nicht nur anlässlich der Krankenbehandlung, sondern auch durch Vorträge aufklärend zu wirken. Sie haben in den letzten Jahren die Alkoholfrage, teils in Sondervorträgen, teils im Anschlusse an den Unterricht über die erste Hilfeleistung bei Unglücksfällen, im ganzen bei mehr als 500 Gelegenheiten behandelt.

Ferner wurden gegen 10,000 Flugblätter und Schriften beschafft zur Verbreitung unter dem Personal und zur Auflage in den Uebernachtungs- und Unterkunftsräumen und an sonst geeigneten Stellen. Es seien genannt: Das im kaiserlichen Gesundheitsamte bearbeitete "Alkoholmerkblatt," die Schriften "Was sollst du vom Bier und Branntwein wissen" von Schindler, "Alkohol und Verkehrswesen" von de Terra, "Soll man bei der Arbeit Alkohol geniessen?" von Grotjahn, endlich die Sammlung von "Vorträgen über die Alkoholfrage" von Koch.

Der deutsche Eisenbahn-Alkoholgegnerverband wird wegen seiner Bestrebungen um die Förderung der Elthaltsamkeitsbewegung unter dem Eisenbahnpersonal von der Verwaltung mit einem namhaften Jahresbeitrag unterstützt.

Gegenstand weiterer Fürsorge ist, dem Personal nach Möglichkeit Gelegenheit zu verschaffen, die Hauptmahlzeiten zu Hause im Familienkreise einzunehmen. Zu diesem Zwecke wird der Dienst so zu gestalten gesucht, dass die Arbeit um die Mittagstunden durch eine längere Pause unterbrochen und abends zeitig beendet werden kann.

Um die Verköstigung in der Familie möglich zu machen, wird für das im Betriebsdienst beschäftigte Personal, so namentlich für Strecken- und Schrankenwärter, die Dienstschicht wo möglich so gelegt, dass Dienstbeginn und Dienstende auf die Mittagstunde fallen.

Für die in nicht zu grosser Entfernung vom Wohnorte beschäftigten Personen, wie besonders die Streckenwärter und Bahnunterhaltungsarbeiter, ist die frachtfreie Beförderung des Essens zu der der Arbeitsstätte zunächst gelegenen Station oder Haltestelle angeordnet.

Die Bahnhofswirte sind vertragsmässig verpflichtet, dem Personal Speisen und Getränke zu ermässigten Preisen, die in einem durch Anschlag bekanntzugebenden Sondertarif festgesetzt sind, zu verabreichen und namentlich auch alkoholfreie Getränke von guter Beschaffenheit in entsprechender Menge und zu billigen Preisen abzugeben. So soll eine Tasse Kaffee oder Tee mit Milch und Zucker zu etwa $\frac{1}{4}$ Liter nicht teurer sein als $\frac{1}{2}$ Liter Bier zu dem für das Personal festgesetzten ermässigten Preis.

In den letzten zwei Jahren haben die in dieser Hinsicht bereits bestehenden Einrichtungen eine wesentliche Erweiterung erfahren, insbesondere sind die Kochgelegenheiten vermehrt worden. So wurden u. a. im Direktionsbezirke Augsburg: 9 Gaskocher, 52 Spirituskocher, 4 Kochöfen, 21 Arbeiterschutzzelte mit Kochöfen; im Direktionsbezirk München: 59 Gaskocher, 25 Spiritus- oder Petroleumkocher, 6 Kochherde und Oefen, 6 Wärmetische und Schränke; im Direktionsbezirk Würzburg: 20 Gaskocher, 24 Spirituskocher, 3 Kochöfen, 24 Schutzzelte mit Kochöfen (zu den schon vor 1906 vorhandenen 31 Zelten) beschafft.

Nach diesen Grundsätzen sind in verschiedenen grösseren Bahnhöfen und Werkstätten Kaffeeküchen eingerichtet, in denen der Kaffee in Maschinen nach Bedarf hergestellt wird. Die Preise sind verschieden festgesetzt, je nach der Zusammensetzung (mit oder ohne Zucker oder Milch und mit oder ohne Zusatz von Malzkaffee) und der gebotenen Menge ($\frac{1}{4}$ bis $\frac{1}{2}$ Liter) und bewegen sich in der Regel zwischen 3 und 6 Pfg.

In den Jahren 1906 und 1907 waren 8 Kaffeeküchen in Betrieb, nämlich in den Hauptwerkstätten Weiden, Nürnberg und München, in den Betriebswerkstätten Nürnberg R. B., Augsburg, Kempten und Lindau und im Bahnhofe Bamberg; 4 Küchen waren nur vorübergehend (zur Winterszeit) im Betrieb. Im ganzen wurden seit der im November 1904 erfolgten Eröffnung der ersten Kaffeeküche in der Hauptwerkstätte Weiden bis zum 1. Juli 1907, 144,918, 1 Kaffee in Portionen zu $\frac{1}{4}$ und $\frac{1}{2}$ l. abgegeben. Besonderen Anklang hat die Verabreichung von Kaffee in der Hauptwerkstätte Weiden gefunden, wo durchschnittlich im Monat 3–4,000 Portionen abgegeben werden. Daselbst wird seit dem 21. Dezember 1905 auch Tee verabfolgt. Der Absatz an Tee betrug bis jetzt im ganzen 27,442 Portionen.

Im Ganzen wurden in der Zeit vom 4. Juli 1904 bis mit 30. Juni 1907 3,052,439 Flaschen verabfolgt und zwar 251,187 Flaschen kohlensaures Wasser ohne Fruchtgeschmack mit 2,801,252 Flaschen kohlensaures Wasser mit Fruchtgeschmack. Das letztere wurde also durchschnittlich etwa 11 mal häufiger begehrt als das erstere. Entsprechend dem vermehrten Bedürfnisse nach kühlenden Getränken zur heissen Jahreszeit und nach wärmenden Getränken zur kalten Jahreszeit weist der Verbrauch von kohlensaurem Wasser eine Steigerung im Sommer, jener von Kaffee eine Steigerung im Winter auf.

Voraussichtlich werden am Schlusse des laufenden Jahres sämtliche Bereitungsanstalten ihre Einrichtungskosten durch Erübrigungen aus dem Betriebe gedeckt haben.

Vier Anstalten haben bereits Reingewinne erzielt, die sich zwischen 880 M. und 3,470 M. bewegen. Diese Beträge werden für Wohlfahrtszwecke verwendet und sind zum Teil schon zu Unterstützungen

an invalide und bedürftige Arbeiter und deren Hinterbliebenen verausgabt worden.

Im Jahre 1906 ist auch die Versorgung des Personals mit frischer Vollmilch in grösserem Umfang, zunächst in den Hauptwerkstätten Weiden und München, versucht worden.

Im laufenden Jahre wurde sodann in weiteren 6 Stellen Milch verabreicht, nämlich in Nürnberg, Hauptwerkstätte und Betriebswerkstätte, Kempten, Betriebswerkstätte, Regensburg, Hauptwerkstätte, Bamberg und Gemünden. Im ganzen betrug der Milchverbrauch 204,218 l. Der Verkaufspreis schwankt zwischen 16–18 Pfg.

Ein anfänglich aussichtsvoller Versuch mit der Abgabe kohlensaurer Milch hat keinen Dauererfolg gehabt.

Die Erkrankungsziffern im Jahre 1906 haben namentlich bei den Mitgliedern der Krankenkasse, die von den oben angeführten Einrichtungen am meisten Gebrauch machen können, eine wesentliche Abnahme aufzuweisen.

Aus einer Einschränkung des Gebrauches geistiger Getränke und aus der Verwendung billiger Ersatzgetränke erwachsen dem Personal aber auch erhebliche wirtschaftliche Vorteile.

Unter der Voraussetzung, dass für jede Verbrauchseinheit der alkoholfreien Getränke ½ Liter Bier konsumiert worden wäre, berechnet sich der Minderaufwand des Personals für Getränke die Summe von rund 250.000 M.

Dienstkündigung wegen Trunkenheit. Da sich in letzter Zeit die Fälle gemehrt haben, in denen Bedienstete, insbesondere auch Beamte, wegen Trunkenheit im Dienste aus ihrer Stellung im Kündigungswege entfernt werden mussten, hat die Generaldirektion der sächsischen Staatsbahnen, den Dresdener Neuesten Nachrichten zufolge, kürzlich erneut darauf hingewiesen, dass im Interesse der Betriebssicherheit und des Ansehens des Eisenbahnpersonals gegen alle diejenigen Bediensteten, die zum Trunke neigen, mit äusserster Strenge vorgegangen wird. Gegebenenfalls ist das Personal von den Dienstvorständen soweit erforderlich, entsprechend aufzuklären und nötigenfalls auf die drohende Dienstkündigung aufmerksam zu machen.

Die Generaldirektion der sächsischen Staatsbahnen hat jetzt angeordnet, dass bei solchen Verfehlungen mit der grössten Strenge verfahren und in der Regel die Dienstentlassung verfügt werden soll. Beamte, die sich lange Zeit hindurch übermässigem Genusse von Alkohol hingeben, müssen pensioniert werden. Um aber den Etat nicht mit Pensionen für Trunksüchtige zu belasten, sollen sämtliche Dienststellen Anzeige erstatten, wenn ein Beamter einen unmässigen Genuss von Alkohol zuneigt, sodass Kündigung erfolgen kann, ehe die Dienstunfähigkeit eintritt. Bedienstete, welche zur Trunksucht niegen, sollen den Vereinen zur Bekämpfung der Trunksucht emp-

fohlen werden, sei es dem Verein enthaltsamer Eisenbahner zu Leipzig, sei es ähnlichen Vereinigungen. Unter Umständen können auch die Vorstände dieser Vereine auf Trunksüchtige aufmerksam gemacht werden. Es soll aber darauf geachtet werden, dass Trinker, die sich den Vereinen angeschlossen haben, von ihren Berufsgenossen schonend gehandelt werden.

Die mecklenburgische Staatsbahnverwaltung hat neuerdings bestimmt, dass ihren Bediensteten in den Bahnhofswirtschaften alkoholfreie Getränke zur Hälfte der für das Publikum festgesetzten Preise zu verabfolgen sind, während die bisherige—auch in Preussen bislang allgemein übliche—Preisermässigung für alkoholhaltige Getränke gänzlich in Fortfall kommt. Für Speisen haben die Bahnhofswirte den Eisenbahnbediensteten nach wie vor höchstens drei viertel der vollen Preise anzurechnen. Hierbei muss hervorgehoben werden, dass im Bereich der mecklenburgischen Staatsbahn die alkoholfreien Getränke von den Bahnhofswirten überhaupt schon verhältnismässig wohlfeil abgegeben werden, und dass diese neue Anordnung dem Eisenbahnpersonal somit ausserordentliche Vergünstigungen gewährt.

Die Direktion der Lübeck-Büchener Eisenbahn stellt unverbesserliche Trinker vor die Wahl, entweder völlig enthaltsam zu werden und dem Guttemplerorden beizutreten, oder aus dem Eisenbahndienst auszuscheiden. Begreiflicherweise wird fast ausnahmslos der Eintritt in den Guttemplerordnen gewählt, der von allen bestehenden Enthaltsamkeitsvereinen über die straffste Organisation verfügt und schon aus manchem verkommenen Trinker für die Dauer wieder einen brauchbaren und tüchtigen Menschen gemacht hat. Vielleicht entschliessen sich auch andere Verwaltungen zu einem Versuch mit diesem Verfahren, das sich bei der Lübeck-Büchener Eisenbahn als überaus zweckmässig bewährt hat.

Den Vorschriften zur Verhütung des Alkoholmissbrauchs (Stuttgart 1909) sind folgende Sätze entnommen:

Wer nicht durchaus nüchtern ist, darf den Dienst nicht antreten. Der Dienstvorgänger darf dem Ablöser den Dienst nicht übergeben, wenn er Zweifel über dessen Nüchternheit hegt. Wer angetrunken in den Dienst kommt oder wer im Dienst sich betrinkt, ist unverzüglich dem nächsten Vorgesetzten anzuzeigen.

Jede Ausschreitung im Genusse alkoholischer Getränke muss wegen der damit verbundenen Gefahr für den Dienst strenge bestraft werden. Wer einen Hang zu solchen Ausschreitungen zeigt, hat damit zu rechnen, dass er aus dem Eisenbahndienst entfernt wird.

Der Verpflegung des Personals, soweit es Mahlzeiten und Erfrischungen ausserhalb des eigenen Hausstandes einzunehmen hat, ist besondere Aufmerksamkeit zuzuwenden. Es ist dafür zu sorgen, dass ihm Gelegenheit geboten wird, sich Speisen (auch Obst) und

alkoholfreie Getränke (Milch, Kaffee, Tee, Mineralwasser, Limonade) zu guter Beschaffenheit und zu billigen Preisen zu verschaffen. Bei den Diensteinteilungen ist darauf Rücksicht zu nehmen, dass das Personal ausreichende Gelegenheit zur Einnahme der Mahlzeiten erhält.

Den Bahnhofwirten ist anzubedingen, dass sie Speisen und alkoholfreie Getränke an das Personal zu mässigen Preisen abzugeben haben. Der Preis für 0.3 Liter Kaffee mit Milch und Zucker oder für 0.3 Liter Milch soll 10 P fg. nicht übersteigen. Zur Abgabe von Speisen und alkoholfreien Getränken sind die Bahnhofwirtschaften nach Bedarf auch nachts offen zu halten. Schnaps und gärender Wein dürfen in diesen Wirtschaften an das Personal (auch an das ausser Dienst tretende) überhaupt nicht, andere alkoholische Getränke nicht in der Zeit von 12 Uhr nachts bis 5 Uhr früh abgegeben werden. Dem in Dienst befindlichen Personal ist verboten, während der bezeichneten Nachtstunden andere Wirtschaften aufzusuchen.

Das Personal soll auf den Wirtshausbesuch möglichst wenig angewiesen sein. In den Aufenthaltsräumen oder in anderen geeigneten Räumen sollen daher Wärm- und Kocheinrichtungen, sowie frisches Wasser zur Verfügung stehen. Soweit ein Bedürfnis vorliegt, werden die Gepäckwagen mit Einrichtungen zum Wärmen und Kochen von Speisen ausgerüstet.

Der Besuch von Wirtschaften ist während der Dienstzeit auf Fälle dringenden Bedürfnisses zu beschränken. Ohne Erlaubnis des Vorgesetzten dürfen Wirtschaften während der Dienstzeit überhaupt nicht aufgesucht werden. Auf Unterwegsstationen mit kurzem Aufenthalt soll dem Zugpersonal eine solche Erlaubnis nicht erteilt werden. Einladungen Dritter zum Trinken sind abzulehnen. Einem etwaigen Missbrauch durch Mitbringen von Getränken in den Dienst ist entgegenzuwirken.

Das Personal ist bei der Einleitung in den Dienst, bei Erkrankungen und bei sonstigen Gelegenheiten über die Nachteile zu belehren, die der missbräuchliche Genuss alkoholischer Getränke zur Folge hat. Beim Beginn jeder Fahrplanperiode sind dem gesamten Personal die zur Verhütung des Alkoholmissbrauches getroffenen Vorschriften von den unmittelbaren Vorgesetzten in Erinnerung zu bringen.

Vor allem sind die Bahnärzte dazu berufen, dem Alkoholmissbrauch entgegenzuwirken durch Belehrung des Personals über die Entbehrlichkeit des Alkoholgenusses und die Nachteile des Alkolholmissbrauches. Wer zum Alkoholmissbrauch neigt, ist im Benehmen mit dem Bahnarzt zu überwachen. Personen, bei denen der Bahnarzt von sich aus eine solche Neigung wahrnimmt, sind von ihm zu verwarnen und den unmittelbaren Vorgesetzten zu bezeichnen.

In einer Amtsblattverfügung vom 3. Juni 1905 werden sehr genaue Anordnungen getroffen betr. Aufenthalts- und Uebernachtungsräume, Kochgelegenheiten und besonders hingewiesen, dass den Bediensteten die Beschaffung eines guten warmen Mittagessens ermöglicht wird.

Eine Anzahl von Gepäckwagen, sowie die Aufenthaltsräume sind mit Gas- und Spirituskochern ausgestattet. Bei grosser Kälte oder Hitze wird Kaffee oder Milch kostenfrei an das Personal verabreicht. Im Ganzen wurden 7,970 Tassen Kaffee und Milch unentgeltlich verabfolgt, was einem Kostenaufwand von 797 Mark entspricht. Ebenso wird auf allen Stationen Sauerwasser mit Citronen oder Himbeersaft vermischt zum Selbstkostenpreise an das Personal abgegeben. Der Verbrauch an Sauerwasser betrug:

	Flaschen.		Flaschen.
1906	1,851,489	1909	843,000
1907	1,695,708	1910	879,185
1908	1,221,511	1911	1,183,913

Im Jahre 1911 hat die Generaldirektion nach die folgende Bekanntmachung veröffentlicht:

DIE GENERALDIREKTION DER
WÜRTTEMBERGER STAATSEISENBAHNEN,
Stuttgart, den 31. Juli 1911.

Das schreckliche Eisenbahnunglück in Müllheim, Baden, soll, wie jetzt behauptet wird, darauf zurückzuführen sein, dass der Lokomotiveführer des verunglückten Zuges vor Antritt des Dienstes statt auszuruhen sich dem Alkoholgenuss hingegeben hatte. Dies gibt mir Veranlassung, auf die Gefahren des Alkoholgenusses wiederholt hinzuweisen. Zumal bei der gegenwärtigen heissen Witterung, wo sich leicht ein starkes Durstgefühl einstellt, kann vor dem Genuss von Alkohol nicht eindringlich genug gewarnt werden.

Ich habe das Vertrauen zu dem gesamten Personal, dass es, der ausserordentlichen Verantwortung des Eisenbahnbetriebsdienstes eingedenk, sich der unbedingt gebotenen Zurückhaltung im Genuss alkoholischer Getränke willig unterzieht und dass nicht nur die Vorgesetzten, sondern auch die Kameraden eines weniger vorsichtigen Beamten, Unterbeamten oder Arbeiters alles daran setzen, ihn vom Alkoholmissbrauch abzuhalten. Dies ist mit Bezugnahme auf die Vorschriften betr. die Verhütung des Alkoholmissbrauches dem gesamten am Betriebsdienst beteiligten Personal urkundlich zu eröffnen.

Alkoholfreies Getränke ist auf allen Stationen stets in genügender Menge und frischem Zustande vorrätig zu halten, auch ist dafür zu sorgen, dass die Aufenthalts- und Uebernachtungsräume in der heissen Zeit besonders sauber behalten werden. Die Aufsichtsbeam-

ten haben dem nüchternen Zustand des Personals, insbesondere des Lokomotivpersonals und des auf den Stellwerken verwendeten Personals ihre besondere Aufmerksamkeit zu schenken.

VON STIELER.

An sämtliche Inspektionen und Haussektionen, sämtliche Stationen, Betriebswerkmeister und Bahnmeister.

Wir fügen noch eine ganze Reihe von Erlassen älteren und neueren Datums der einzelnen Direktionen bei, aus welchen hervorgeht, wie auf der ganzen Linie die Notwendigkeit des Kampfes gegen den Alkoholismus immer klarer erkannt wird. Besonders wichtig sind die Erlasse der Eisenbahndirektion Breslau, welche dank dem hervorragender Interesse des Herrn Eisenbahndirektionspräsidenten Dr. Mallison, die Bestrebungen der Antialkoholvereine, und namentlich des Eisenbahn-Alkoholgegner-Verbandes tatkräftig unterstützt.

Altona. In letzter Zeit haben mehrere Arbeiter und Beamte wegen hochgradiger Trunkenheit im Dienste oder mehrfacher schwerer Verfehlungen infolge fortgesetzten übermässigen Alkoholgenusses mit Dienstentlassung bestraft werden müssen. Wir sehen uns daher veranlasst, wiederholt auf die ungünstigen Folgen des übermässigen Alkoholgenusses aufmerksam zu machen und besonders vor dem Genuss von Schnaps innerhalb der Dienstzeit eindringlich zu warnen. Trunkenheit im Dienst wird streng, nötigenfalls mit Dienstentlassung bestraft werden. In Rücksicht auf den ungünstigen Einfluss, den die Gewohnheitstrinker auf die übrigen Bediensteten ausüben und auf die Gefahr, welche dadurch für die Sicherheit des Betriebes und der Bediensteten selbst entsteht, muss es Ziel der Verwaltung sein, die jenigen, die trotz wiederholter Verwarnungen vom Trunke nicht ablassen, aus ihrem Dienstverhältnis zu entfernen. Die Dienstvorgesetzten werden angewiesen, jeden Fall der Trunkenheit im Dienst ohne Ausnahme zur Bestrafung anzuzeigen. Die Bahn- und Kassenärzte sind ersucht, die Bediensteten, die sich wiederholt durch Trunkenheit dienstunfähig machen, der Verwaltung namhaft zu machen. Aufgabe der Inspektionsvorstände ist es, stets ihr Augenmerk darauf zu richten, dass da, wo ein Bedürfnis sich dafür herausstellt, allen Bediensteten ausreichende Gelegenheit zum Genuss alkoholfreier Getränke, insbesondere von gutem Trinkwasser, Kaffee und dergleichen geboten wird.

VERFÜGUNG DER KGL. EISENBAHNDIREKTION BERLIN, BETREFFEND GENUSS ALKOHOLHALTIGER GETRÄNKE WÄHREND DES DIENSTES.

Obgleich anerkannt werden muss, dass der Genuss von alkoholhaltigen Getränken unter den Bediensteten, denen er bisher während des Dienstes nicht verboten worden ist, durch den gesteigerten Ver-

brauch alkoholfreier Getränke, wie Brausewasser, Brauselimonaden, Kaffee, Tee, Milch und dergleichen, nicht unwesentlich zurückgegangen ist, haben wir doch zu unserem Befremden feststellen müssen, dass von einem Teil der Bediensteten—auch der in den Hauptwerkstätten beschäftigten—immer noch alkoholhaltige Getränke, insbesondere Lager- und Flaschenbier, in erheblichem Mass während des Dienstes genossen werden.

Diese Feststellung hat uns die Frage nahegelegt, ob es nicht angebracht wäre, das bereits für die im Betriebsdienste beschäftigten Bediensteten bestehende Verbot des Genusses alkoholhaltiger Getränke während des Dienstes auch auf die übrigen Klassen der Eisenbahnbediensteten auszudehnen. Nach eingehender Prüfung haben wir jedoch beschlossen, von dieser äussersten Massregel zunächst noch in der Erwartung abzusehen, dass durch die Inanspruchnahme der in den letzten Jahren geschaffenen und stetig vermehrten Wohlfahrtseinrichtungen, wie Brausewasseranstalten, Kaffee-, Teeküchen und dergleichen, der Genuss von alkoholhaltigen Getränken während des Dienstes immer mehr zurückgehen und der Verbrauch an alkoholfreien Getränken sich weiter heben wird.

Wir vertrauen, dass die dem Betriebsdienste nicht angehörigen Bediensteten eingedenk des schädlichen Einflusses, den der Alkohol auf die Gesundheit und die Arbeitsfähigkeit ausübt, sich bemühen werden, den Alkoholgenuss während des Dienstes immer mehr einzuschränken. Sollte wider Erwarten der Verbrauch an alkoholhaltigen Getränken durch das Dienstpersonal trotz dieser Mahnung motivierten erheblichen Rückgang erfahren, worüber wir nach Ablauf keinen angemessenen Frist weitere Erhebungen anstellen werden, so einer angemessenen Veranlassungen sein, das Verbot jeglichen Alkoholgenusses würden wir gezwungen sein, es für alle Eisenbahnbediensteten einzuführen.

Für die im Betriebsdienste beschäftigten Bediensteten bleibt das durch die Amtsblattverfügungen vom 16. November Dezember 1905 (S. 830) und vom 2. Januar 1906 (S. 20) erlassene Verbot des Genusses alkoholhaltiger Getränke während des Dienstes unverändert bestehen. Die genannten Bestimmungen sowie der [illegible] Verbot es betreffende Aushang Nr. 7026 sind nach wie vor streng [illegible] zu beachten. (Amtsblatt Nr. 4, 1912, Nr. 67.)

In neuerer Zeit hat die Königliche Eisenbahndirektion Breslau Vorsorge getroffen, dass auf diejenigen Bediensteten, die sich gewohnheitsmässig dem übertriebenen Alkoholgenuss hingeben, fortgesetzt moralisch eingewirkt wird, damit sie [illegible] Persönlichkeit vor Rückfällen bewahrt bleiben. Sie bedient sich [illegible] dabei der Mitwirkung der Mässigkeits- und Enthaltsamkeitsvereine in der Erwägung, dass nur durch die ständige Einwirkung [illegible] eines solchen Vereins und durch den Umgang mit Mitmenschen, [illegible] Alkoholmissbrauch fernstehen und vorbildlich auf den Trinker, dieser wieder

auf den rechten Weg gelangen kann. Da die Eisenbahndirektion in den weitaus meisten Fällen erst dann von der Trunkfälligkeit eines Bediensteten Kenntnis erhält, wenn die Inspektion die Erteilung der Genehmigung zu seiner Entlassung oder die Einleitung des Disziplinarverfahrens auf Dienstentlassung beantragt, und die Eisenbahndirektion mithin in diesem Stadium nicht mehr in der Lage ist, die zur Besserung des Gewohnheitstrinkers notwendigen Massregeln zu ergreifen, so ist angeordnet, dass von jeder Bestrafung eines Beamten oder Hilfsbeamten wegen Trunkenheit alsbald der Königlichen Eisenbahndirektion Anzeige erstattet werden muss. Vor Erstattung der Anzeige ist dem Bediensteten, sofern es sich um einen Gewohnheitstrinker handelt, auf das eindringlichste zu empfehlen, einem Mässigkeits- oder Enthaltsamkeitsverein beizutreten. Die Dienststellenversteher sind angewiesen, es sich zur besonderen Aufgabe zu machen, dass der Bedienstete diesem Rat Folge leistet. Sie sollen sich hierbei der Mitwirkung des Bahnarztes und, sofern es die Familienverhältnisse irgend zulassen, auch der Mitwirkung der Ehefrau des Trinkers bedienen. Letzterer und dem Bediensteten selbst ist kein Zweifel darüber zu lassen, dass über sein Verhalten der Königlichen Eisenbahndirektion berichtet werden muss, und dass er, wenn er den ihm gegebenen Rat nicht befolgt, bei etwaiger Rückfälligkeit auf keinerlei Nachsicht zu rechnen hat, da aus der Nichtbefolgung des Rates geschlossen werden muss, dass ihm der ernstliche Wille zur Besserung fehlt. Auch denjenigen Eisenbahnbediensteten, die zwar noch nicht wegen Trunkenheit im Dienst bestraft werden mussten, die aber gleichwohl als Trinker bekannt sind, wird der Anschluss an einen Mässigkeits- oder Enthaltsamkeitsverein nahe gelegt.

Bei der Erstattung der Anzeige von der Bestrafung ist gleichzeitig zu berichten, welchen Erfolg die dem Bediensteten erteilten Ratschläge gehabt haben und ob, gegebenenfalls welchem Mässigkeits- oder Enthaltsamkeitsverein er beigetreten ist. In jedem Falle hat der Dienststellenvorsteher mit dem Bediensteten eine besondere Verhandlung aufzunehmen, die dem Bericht beizufügen ist. Auf Grund dieser Berichte soll von Zeit zu Zeit nachgeprüft werden, ob diejenigen Bediensteten, die in einen Mässigkeitsverein oder Enthaltsamkeitsverein eingetreten sind, nicht etwa inzwischen die Mitgliedschaft aufgegeben haben und welchen Einfluss die Zugehörigkeit zu einem solchen Verein auf sie ausgeübt hat. Es werden ferner auf Grund dieser Berichte regelmässig monatlich die erfolgten Bestrafungen wegen Trunkenheit im Amtsblatt ohne Namensnennung bekanntgegeben.

Dieses Verfahren ist vorläufig auf die Beamten und Hilfsbeamten beschränkt. Es soll aber, sobald hinreichende Erfahrungen gesammelt sind und das Verfahren sich bewährt hat, auch auf die Arbeiter ausgedehnt werden. Inzwischen sind lediglich die Inspektionen

angewiesen, auch auf die Arbeiter in geeigneten Fällen entsprechend einzuwirken. Von der Unterbringung der Bediensteten in Trinkerheilstätten ist bisher abgesehen worden, da zunächst das Ergebnis der Verhandlungen des Wohlfahrtsausschusses über diese Frage abgewartet werden soll.

Die Königl. Eisenbahndirektion Breslau hat folgende Amtsblattverfügung vom 6. August 1910 erlassen:

Wenn die Bestrebungen zur Bekämpfung des Alkoholgenusses bei den Eisenbahnbediensteten den gewünschten Erfolg haben sollen genügt es nicht, in Verfehlungsfällen Bestrafung unter Androhung der Dienstentlassung eintreten zu lassen, sondern es wird alsbald Vorsorge getroffen werden müssen, dass der betreffende Bedienstete nach Möglichkeit von einem Rückfalle bewahrt wird. Es ist eine bekannte Tatsache, dass der Gewohnheitstrinker, der sich selbst überlassen bleibt, meist nicht imstande ist, sich aus eigener Kraft dem Alkoholgenuss fernzuhalten; es muss deshalb dauernd moralisch auf ihn eingewirkt werden. Diesen Zweck erfüllen am besten die Mässigkeits- und Enthaltsamkeitsvereine. Nur durch die ständigen Einwirkungen eines solchen Vereins und durch den Umgang mit Mitmenschen, die dem Alkoholmissbrauch fernstehen, kann der Trinker wieder auf den rechten Weg gelangen.

Es ist daher jeder Bedienstete, der dem Trunke ergeben ist, und wegen Trunkenheit im Dienst bestraft werden muss, nicht nur vor der Wiederholung einer solchen Verfehlung ernst zu verwarnen und auf deren Folgen zu verweisen, sondern es ist ihm auf das eindringlichste zu empfehlen, einem Mässigkeits- oder Enthaltsamkeitsverein beizutreten. Für den Beitritt zu einem solchen Verein wird sich in den meisten Fällen Gelegenheit bieten. Die Blaukreuzvereine, die Guttemplerlogen u. a. m., die alle die Bekämpfung des Alkohols bezwecken, haben an allen Orten Zweigvereine. Für die Bediensteten katholischer Konfession kommt u. a. auch der Verein abstinenter Katholiken Deutschlands in Frage. In Breslau ist in letzter Zeit eine Ortsgruppe des Eisenbahn-Alkoholgegner-Verbandes gegründet worden, an welche die Bediensteten in Breslau und der nächsten Umgebung zu verweisen sein werden. Vorsitzender dieser Ortsgruppen ist der Ober-Materialien-Vorsteher Hartlieb bei der Werkstätten-Inspektion I, Breslau. Auch solchen Eisenbahnbediensteten, die zwar noch nicht wegen Trunkenheit im Dienst bestraft werden mussten, von denen aber bekannt ist, dass sie Trinker sind, wird der Anschluss an einen Mässigkeitsverein nahezulegen sein.

Im Bezirk der Königlichen Eisenbahndirektion Bromberg fand bisher die Auszahlung des Arbeitslohnes an die Arbeiter der Hauptwerkstatt Bromberg den Bestimmungen der Werkstättenordnung gemäss kurz vor Schluss des Feierabends an zwei Zahlstellen statt. Klagen über verspätete Zahlung haben dazu geführt, dass seit kur-

zem das Zahlgeschäft auf die letzte Viertelstunde der Vormittagsarbeitszeit verlegt und zugleich die Zahlstellen um zwei vermehrt worden sind. Diese Massnahmen haben, der "Zeitung des Vereins D. E. V." zufolge, den rückhaltlosen Beifall der Arbeiter gefunden. Diese erhalten jetzt innerhalb einer Viertelstunde ihren Lohn, können das empfangene Geld bei hellem Tageslicht besser durchzählen und genauer mit dem Abrechnungszettel vergleichen. Abgesehen hiervon werden auch die Arbeiter durch die kurze Mittagszeit und das Bewusstsein, am Nachmittage noch arbeiten zu müssen, vielfach davon abgehalten, sich mit ihrem Arbeitsverdienst in Schankwirtschaften zu begeben, wo dann ein mehr oder minder beträchtlicher Teil des sauer erworbenen Geldes an alkoholischen Getränken angelegt zu werden pflegte.

Die Eisenbahn-Direktion Cöln bringt im Amtsblatt A. Nr. 43, vom 12. Oktober folgende beachtenswerte Bekanntmachung:

Vor kurzer Zeit ist festgestellt worden, dass in einem Befehlsstellwerk auf Veranlassung des Fahrdienstleiters während des Dienstes Kornbranntwein geholt wurde, dass sämtliche (daselbst) beschäftigte Bedienstete gemeinsam diesen getrunken und sich mehr oder weniger betrunken haben, dadurch sind Unregelmässigkeiten im Zugverkehr veranlasst worden, die geeignet waren, Betriebsunfälle herbeizuführen. Die betreffenden Bediensteten sind mit hohen Geldbussen bestraft und aus dem Betriebsdienste zurückgezogen worden. Von strengeren Massnahmen ist lediglich deshalb Abstand genommen worden, weil es sich um Bedienstete von straffreier oder längerer zufriedenstellender Dienstführung gehandelt hat. Den Beteiligten ist aber die unnachsichtliche Dienstentlassung für den Fall angedroht worden, dass sie noch einmal des Alkoholgenusses im Dienste überführt oder in angetrunkenen Zustande während des Dienstes betroffen werden sollten. Wir warnen vor dem Alkoholgenuss und bringen die wiederholten Verbote u. a. Amtsblatt A von 1902, S. 112, von 1905, S. 120, sowie 1906 (S. 19/21 und 118) in Erinnerung. Die Dienststellenvorsteher werden angewiesen, sämtliche Bedienstete von Zeit zu Zeit auf die Bestimmung hinzuweisen, und die Inspektionsvorstände wollen sich davon überzeugen, dass dies geschieht.

VERFÜGUNGEN DER KGL. EISENBAHNDIREKTION DANZIG BETREFFEND MITGLIEDSCHAFT BEI ENTHALTSAMKEITSVEREINEN.

Ein Beamter unseres Bezirks ist wegen seiner Zugehörigkeit zu einem Enthaltsamkeitsverein von seinen Mitbeamten verspottet und verhöhnt worden, sodass er seinen Austritt aus dem Verein beantragt hat; dieses Verhalten der Mitbeamten ist durchaus zu tadeln. Die Bediensteten sollten es freudig begrüssen, wenn ihre Kollegen die Neigung zum Alkoholgenuss mit Energie und Willensstärke durch

Beitritt zu einer Enthaltsamkeitsvereinigung zu überwinden suchen, die durch ihre Grundsätze, Belehrungen und Bestrebungen die Rückkehr auf den richtigen Weg und in geordnete Verhältnisse unterstützt und somit schwere Verfehlungen mit ihren Folgen einzuschränken sucht. Derartige Bestrebungen müssen von sämtlichen Bediensteten auch im Interesse der Standesehre unterstützt und gefördert werden. Wir vertrauen darauf, dass dieser Hinweis genügt.

Sollte aber wider Erwarten sich der eingangs vermerkte Fall wiederholen, so werden wir die Schuldigen zur Rechenschaft ziehen. Diese Verfügung ist sämtlichen Bediensteten bekannt zu geben. (Amtsblatt Nr. 12, 1912, Nr. 29.)

ABGABE VON MILCH AN DAS EISENBAHNPERSONAL.

Die Königliche Eisenbahndirektion Frankfurt a. M. hat die Bahnhofswirte ihres Bezirks verpflichtet, an die Eisenbahnbediensteten gute Milch zum Preise von 7 Pfg. für $\frac{2}{10}$ Liter abzugeben. Den Anlass zu dieser nachahmenswerten Anordnung dürften die überaus günstigen Erfahrungen gegeben haben, die in der von der Gesellschaft für Wohlfahrtseinrichtungen in Frankfurt a. M. eingerichteten und betriebenen Eisenbahner-Verpflegungsanstalt mit der Abgabe von Milch gemacht worden sind. Es werden dort neuerdings monatlich rund 10,000 Gläser Milch ($\frac{3}{10}$ Liter zu 6 Pfg.) verkauft. In einem von der genannten Gesellschaft ganz in der Nähe errichteten Kaffee- und Milchausschank werden ausserdem monatlich rund 1,000 Tassen Kaffee, 3,000 Tassen Schokolade und 12,000 Gläser Milch (zu 5, 10, and 6 Pfg.) verkauft. Auch an diesem Verbrauch ist das Eisenbahnpersonal stark beteiligt.

Die Königlichen Eisenbahn-Direktionen Halle und Cassel sowie die Generaldirektion der elsass-lothringischen Eisenbahnen haben das Alkoholverbot unverzüglich auf das gesamte Personal ausgedehnt, wobei auch zugunsten der oberen Beamten keine Ausnahme gemacht wurde. Diesem Beispiel ist nun auch die Königliche Eisenbahndirektion Altona durch nachstehende Verfügung gefolgt:

"Auf allen Gebieten der Wohlfahrtspflege für die Eisenbahnbediensteten sind nunmehr durch die Erhöhung der Leistungsfähigkeit der Anlagen zur Herstellung kohlensäurehaltiger Getränke, durch die Beschaffung und Inbetriebnahme von Kaffeemaschinen und durch die Einrichtung von Heiss- und Trinkwasseranlagen hinreichende Vorkehrungen getroffen, die jedem Bediensteten die eigene Zubereitung oder den billigen Bezug von warmen oder kühlenden Getränken ermöglichen. Dadurch sind die Bedenken beseitigt, die die weitere Ausdehnung des Verbotes des Genusses alkoholhaltiger Getränke während des Dienstes auf sämtliche Beamte, Hilfsbeamte

und Arbeiter bisher hintan gehalten haben. Es wird daher das für alle im Betriebsdienste einschliesslich des Fahr-, Rangier- und Bahnbewachungsdienstes sowie im Bahnsteigschaffner-, Portier- und Wächterdienst tätigen Beamten, Hilfsbeamten und Arbeiter erlassene Verbot des Alkoholgenusses während des Dienstes auf sämtliche Bedienstete in allen anderen nicht genannten Dienstzweigen mit der Einschränkung ausgedehnt, dass den letzteren der Genuss von Weiss- und Braunbier in mässigen Grenzen auch fernerhin gestattet werden soll. Nur den Hauswarten in den Uebernachtungsräumen und Aufenthaltsräumen für Lokomotiv- und Fahrbeamte wird mit Genehmigung des zuständigen Inspektionsvorstandes die Abgabe leichter alkoholhaltiger Getränke an die Benützer dieser Räume zum Genuss während der Dienstpausen gestattet. Branntwein und branntweinähnliche Getränke bleiben selbstverständlich auch hier ausgeschlossen. Wir erwarten von dem Pflichtgefühl unserer Bediensteten die genaue Befolgung dieser Anordnung und hegen das Vertrauen, dass die Dienststellenvorsteher uns in unserem Vorhaben in jeder Weise tatkräftig unterstützen und jeden Uebertretungsfall unnachsichtlich verfolgen werden."

Die Königliche Eisenbahndirektion Kattowitz hat nachstehende Verfügung erlassen:

" Wir haben Veranlassung, wiederholt die Dienstvorgesetzten der Betriebstellen darauf hinzuweisen, dass kein Beamter den Betriebsdienst übernehmen darf, wenn er durch Alkoholgenuss geschwächt ist, und dass die Vorgesetzten einen durch Alkoholgenuss geschwächten Beamten sofort aus dem Betriebsdienste zu entfernen haben. Es ist aber auch Pflicht aller anderen Beamten, sobald sie einen durch Alkoholgenuss geschwächten Beamten im Dienst bemerken, davon dem nächsten Dienstvorgesetzten Anzeige zu erstatten, widrigenfalls sie sich selbst strafbar machen. Das Mitbringen von Schnaps und schnapsähnlichen Getränken in den Dienst ist sämtlichen Bediensteten bei Strafe verboten. Dieses Verbot wird wiederum in Erinnerung gebracht. Sämtliche Dienstvorgesetzte werden angewiesen, für die unbedingte Befolgung Sorge zu tragen und jede Uebertretung bei der vorgesetzten Inspektion zur Anzeige zu bringen. Die Inspektionen haben jede Zuwiderhandlung gegen das Verbot streng zu bestrafen."

Das Verbot des Genusses alkoholischer Getränke während des Dienstes. Die Königliche Eisenbahndirektion in Königsberg i. Pr. hat kürzlich an die Inspektionen und Bauabteilungen ihres Bezirks nachstehende Verfügung ergehen lassen: " Wir haben Anlass, das Verbot des Genusses alkoholhaltiger Getränke während des Dienstes in Erinnerung zu bringen und von neuem darauf hinzuweisen, dass es allen Bediensteten Ehrensache sein muss, ihre Mitbediensteten vom übermässigen Alkoholgenuss zurückzuhalten, desgleichen, dass

jeder Eisenbahnbedienstete, der bemerkt, dass ein anderer bei angetrunkenem Zustande seinen Dienst verrichtet oder ihn zu verrichten sich anschickt, verpflichtet ist, dies dem nächsterreichbaren Vorgesetzten des dienstunfähigen Mannes zu melden. Die Dienstvorsteher haben die Bediensteten, die im Verdachte stehen, zum Alkoholmissbrauch zu neigen, ständig in geeigneter Weise zu beobachten. Die Einhaltung des Alkoholverbotes ist den Bediensteten durch die verwaltungsseitige Einrichtung von Selterwasseranlagen und Kaffeeküchen inzwischen wesentlich erleichtert worden. Selterwasseranlagen befinden sich zurzeit auf den Bahnhöfen Allenstein, Braunsberg, Eydtkuhnen, Insterburg, Lyck, Memel, Neidenburg, Prostken, und Tilsit, sowie bei den Hauptwerkstätten in Königsberg und Ponarth; Kaffeeküchen sind im Betriebe auf den Bahnhöfen Lyck, Osterode und Prostken sowie bei den Hauptwerkstätten in Königsberg und Ponarth. Diese Verfügung ist sämtlichen Beiensteten mit dem Hinweise darauf bekannt zu geben, dass Verstösse gegen das Alkoholverbot empfindlich bestraft werden und unter Umständen die schon früher bekannt gegebenen Folgen haben."

Meldung von Trünkenheit. Die Königliche Eisenbahndirektion zu Stettin hat kürzlich die nachstehende bemerkenswerte Verfügung an das Lokomotivpersonal des Bezirks erlassen:

"Einem geprüften Lokomotivheizer ist die Führung einer Lokomotive ohne Bedenken übertragen worden, weil es nicht bekannt war, dass er dem Trunke zuneigte, da die Mitbeamten mit Rücksicht auf die Familie dem vorgesetzten Werkmeister die von ihnen beobachteten Fälle von Trunkenheit nicht gemeldet hatten. Der Heizer hat sodann einen Betriebsunfall verschuldet und ist wegen fahrlässiger Gefährdung eines Eisenbahntransportes gerichtlich bestraft worden. Wir erwarten mit Bestimmtheit, dass jeder Lokomotivbeamte im Interesse der Betriebssicherheit und der Standesehre dem nächsten Dienstvorgesetzten den Lokomotivbeamten namhaft macht, bei dem Neigung zum Trunke vorliegt, damit dessen Entfernung aus dem Zugbeförderungsdienst zur Vermeidung von Unfällen von unabsehbaren Folgen angeordnet werden kann."

Der deutsche Eisenbahn-Alkoholgegner-Verband wurde am 26. Januar 1902 von dem, um die Enthaltsamkeitsbewegung hochverdienten, Eisenbahndirektor de Terra ins Leben gerufen, und gewann in kurzer Zeit 300 Mitglieder, eine Zahl, die im ersten Jahre auf 500 stieg. Jedoch liess die anfängliche Begeisterung, wie es stets der Fall zu sein pflegt, bald nach, dem Zugang der Mitglieder stand ein nicht unerheblicher Abgang gegenüber, und verschiedene Umstände übten auf das Wachstum des Vereins einen ungünstigen Einfluss aus. So wuchs die Mitgliederzahl nur langsam. Auch die Herausgabe einer eigenen Zeitung stiess auf grosse Schwierigkeiten und war mehrfachen Wandlungen unterworfen.

Die Generalversammlungen fanden statt 1902 in Kiel, 1903 in Berlin, 1904 in Altona, 1905 in Dresden, 1906 in Elberfeld, 1907 in Berlin, 1908 in Stettin, 1909 in Bremen, 1910 in Cöln, 1911 in Hamburg, 1912 in Freiburg i. Br.

Jetzt beträgt die Mitgliederzahl 950. Das Vereinsorgan "Der Pionier" erscheint in einer Auflage von 2,100 Exemplaren (Geschäftsstelle: Herr P. Merx, Cöln a. Rh., Alteburgerstr. 87, II.) Folgende Schriften sind herausgegeben: (1) Alkohol und Verkehrswesen; (2) Alkohol und Verkehrssicherheit.

Beide von Herrn Eisenbahndirektor de Terra. Verlag des deutschen Vereins gegen den Missbrauch geistiger Getränke. Im eigenen Verlag: "Was muss der Eisenbahner vom Alkohol wissen?" von Dr. Paltzow. Ferner die Flugblätter: "Was will der Eisenbahn-Alkoholgegner-Verband?" und "Urteile der Aerzte über die gesundheitlichten Schäden des Alkoholgenusses."

Das Vereinszeichen ist ein blauer Knopf mit goldenem Flügelrad. Es werden Mitglieder, Teilnehmer und Freunde aufgenommen, auch können die Frauen der Mitglieder dem Verein beitreten. Unterstützungen wurden gewährt von—

Der Königl. Bayrischen Staatsbahn	200
Grossherzgl. Badische Staatsbahn	100
Lübeck-Büchener Eisenbahn-Gesellschaft	100
Privatbahn Berufsgenossenschaft Lübeck	50
Grossherzogl. Oldenburg. Staatsbahn	50
Grossherzogl. Schweriner Staatsbahn	40

und von verschiedenen anderen Gesellschaften kleinere Beiträge.

Vorsitzender des deutschen Eisenbahn-Alkoholgegner-Verbandes ist der Unterzeichnete, Schriftführer Herr Bahnhofsvorsteher Sydow, Stettin-Torney.

Auf Anregung des deutschen Eisenbahnalkoholgegner-Verbandes wurde anlässlich des XI. Internationalen Congresses gegen den Alkoholismus in Stockholm (28. Juli–3. August 1907) der internationale Eisenbahn-Alkoholgegner-Verband gegründet; dessen Versammlungen stets mit den, alle 2 Jahre stattfindenden internationalen Congressen zusammenfallen. Als internationales Vorbandszeichen wurde der blaue Knopf mit dem goldenen Flügelrad gewählt. Jetzt gehören folgende Länder dem internationalen Verbande an: Finnland (1,100), Schweden (4,597), Norwegen (557), Dänemark (650), England (58,000), Frankreich (4,800), Holland (465), Schweiz (561), Oesterreich (150), Serbien (70), Deutschland (950 Mitglieder).

Geschäftsführer des internationalen Eisenbahn-Alkoholgegner-Verbandes ist Herr G. A. Kinker, Utrecht, Joh. de Bekastrasse 39, II, Vorsitzender der Unterzeichnete.

In Dänemark gab es vor einigen Jahren, die Zahlen sind nicht ganz neu, 303 Stationen, Halte- und Billetausgabestellen, aber nur 61 Bahnhofswirtschaften, darunter nur 13 ländliche.

Für die Bahnhofswirtschaften, ausgenommen Copenhagen, wo besondere Bestimmungen gelten, sind für die Abgabe von Getränken an das fahrende Dienstpersonal besonders niedrige Preise festgesetzt, für spirituöse Getränke wird jedoch keine Preisermässigung gewährt. Für das lokale Dienstpersonal wird bei der Abgabe von Milch, Kaffee, Tee, u. s. w., eine Preissermässigung von 25 prozent gewährt. Auch für Copenhagen gilt die Bestimmung, dass es für alkoholhaltige Getränke keine Preissermässigung gibt. In den Kantinen darf zu jeder Mahlzeit nur eine Flasche Bier verabreicht werden, und diese muss voll bezahlt werden. Im Uebrigen dürfen in den Kantinen keine alkoholhaltigen Getränke verkauft werden. In besonders strengen Wintern wird dem Zug- und Lokomotivpersonal warmes Weissbier (gleich unserem Braunbier) unentgeltlich verabfolgt, ebenso bei besonders anstrengendem Dienst an Sonntagen.

Es ist dem Personal nicht verboten, alkoholische Getränke während der Dienstzeit einzunehmen. Dagegen ist verordnet, dass, wenn ein Dienstversäumnis durch Alkoholgenuss verursacht, dieses bei der Generaldirektion direkt angezeigt werden soll. Bei dem ersten Fall wird der Angeklagte mit einer Geldstrafe bestraft und bei Wiederholung wird ihm mit dienstlicher Entlassung gedroht. Diese letzte Bestimmung ist neulich von dem Minister der öffentlichen Arbeiten ausgegeben. Als "prevention is better than cure" gibt es endlich eine Bestimmung, nach welcher mindestens ein jährige-abstinente Bewerber mit sonst gleichen Qualifikationen bei der Anstellung von Bediensteten vorgezogen werden.

Ueber die Vereinsverhältnisse gibt uns Herr Gustav Hansen, Kopenhagen, Monradolf 17, Vorsitzender des dänischen Vereins enthaltsamer Eisenbahner den folgenden Bericht:

Die Bewegung hat ungefähr in derselben Zeit begonnen wie in Deutschland. Der dänische Eisenbahnalkoholgegnerverein (Danske Iernbaners Afholdsselskab) wurde im März, 1902, gestiftet und zählte 300 Mitglieder. Von diesen sind nach und nach einige ausgetreten; aber trotzdem ist die Mitgliederzahl im Verlaufe von 7 Jahren auf 650 gewachsen. Der Verein hat sich also um rund 50 Mitglieder jährlich vermehrt. Hierbei ist zu bemerken, dass bei dieser Zahl etwa 50 Frauen und Kinder der Angestellten eingerechnet sind, da diese nach Beschluss der letzten Jahresversammlung als Mitglieder aufzunehmen sind. Die Kinder sind jedoch ohne Stimmrecht. Der Verein umfasst sowohl das Personal der Staats- als auch der Privatbahnen. Man kann wohl rechnen, dass etwa 4 Prozent des gesammten Personals in unserem Verein aufgenommen ist; indessen glaube ich dass noch etwa 4 Prozent des Personals in anderen Abstinenzorganisationen Aufnahme gefunden haben. Es wird also 8 Prozent des gesamten Bahnpersonals in Dänemark abstinent sein.

Der Verein wird von einem Vorstand, aus 5 Mitgliedern bestehend, geleitet. Das Land ist in 20 Kreise eingeteilt, in denen ein Leiter die Beiträge einkassiert und neue Mitglieder aufnimmt. Wir haben unsere eigene, monatlich erscheinende Zeitung, die die Mitglieder unentgeltlich erhalten und auch in den Warteräumen der Eisenbahnärzte ausliegt. Der jährliche Beitrag beträgt 1.40 Kr., für Mann und Frau zusammen 2 Kr. Die Kinder zahlen keine Beiträge, müssen aber wie die Erwachsenen ein Eintrittsgeld von 1 Kr. bezahlen, für welches sie ein Exemplar der Statuten und ein Abzeichen erhalten. Die Höhe des Beitrages ist kein Hindernis für den Beitritt zum Verein. Als absolute Aufnahmebedingung wird verlangt, dass das Mitglied keine alkoholischen Getränke einnehmen oder ausgeben darf. Es ist zu bemerken, dass das sogenannte schwache oder steuerfreie Bier erlaubt ist. Dagegen haben wir nicht Teilnehmer oder Freunde. An denjenigen Stellen, wo ein grösseres Personal vorhanden ist, haben wir regelmässige Versammlungen alle 14 Tage, auf welchen wir für gute Vorträge, musikalische Darbietungen u. s. w. sorgen. Im Sommer schliessen sich die einzelnen Kreise zusammen und machen Ausflüge. Im letzten Jahr haben wir uns eine neue Aufgabe gestellt, indem wir den einen Teil unserer Einnahmen für die Erhaltung eines früheren Mitgliedes in einer Trinkerheilanstalt verwandten und ihn dadurch für seine Familie wieder zu gewinnen suchten; wir hoffen, falls die Behandlung gelingt, ihn wieder angestellt zu sehen.

Schliesslich möchte ich auch erwähnen, was von seiten der Direktion gemacht wird, um der Eisenbahn ein nüchternes Personal zu geben. Es wird unserem Verein auf verschiedene Weiss entgegengekommen. So erhalten wir einen jährlichen Beitrag von 500 Kr. vom Staate. Zu unseren Jahresversammlungen bekommen die Teilnehmer soweit als möglich Urlaub und auch die Frauen anhalten dazu eine Freifahrt. So wird es auf diese Weise möglich, eine bedeutende Anzahl von Mitgliedern bei dieser Gelegenheit zu versammeln, was von gewisser Bedeutung ist und eine Art Massendemonstration bedeutet.

Auch in England existiert kein Alkoholverbot für die Eisenbahner, aber man erwartet von dem Personal, dass es sich während des Dienstes der Mässigkeit befleissigt. Auf den Bahnhöfen gibt es Kantinen und Kaffeeschenken, wo das Personal Kaffee, Thee, Milch, u. s. w., zu mässigen Preisen erhalten kann. Den Bestrebungen des englischen Vereins enthaltsamer Eisenbahner bringen die Verwaltungen der einzelnen Eisenbahngesellschaften grosse Sympathie entgegen und unterstützen dieselben in Wort und Schrift. Auch die städtischen Behörden sind stets bei den Generalversammlungen und den Festlichkeiten des Vereins vertreten. Der Verein geniesst weder staatliche, noch städtische Unterstützungen, auch die Eisen-

bahngesellschaften geben offiziell keine Beiträge, jedoch haben einzelne Direktoren privatim Beiträge gezeichnet. Die Mitglieder werden bei der Anstellung nicht bevorzugt. Eine Statistik über Eisenbahnunglücksfälle, welche auf Alkoholismus zurückzuführen sind, gibt es nicht; die Bemerkung " durch Trunk verursacht " findet sich bisher selten in den Akten.

Ueber den Verein selbst gibt nähere Nachricht der folgende Bericht:

Der englische E. A. G. V. marschiert mit seiner ausserordentlich grossen Mitgliederzahl von 58,000 Eisenbahn-Alkoholgegnern an der Spitze des internationalen Verbandes. Die englische Landesgruppe, " United Kingdom Railway Temperance Union," ist nicht allein die grösste, sondern auch die älteste Landesgruppe. Die Gründung fand im Jahre 1882 statt. Das Wachstum der engl. Gruppe nahm folgenden Verlauf:

Im Jahre—	Mitgliederzahl.	Im Jahre—	Mitgliederzahl.
1884	5,880	1904	22,615
1885	7,497	1905	25,000
1888	12,578	1906	35,419
1892	14,921	1907	37,947
1895	15,797	1908	42,978
1898	19,230	1909	47,651
1902	19,834	1910	54,804
1903	21,892	1911	58,000

Der Mitgliederbestand setzt sich zusammen aus Enthaltsamen und Mässigen, sowie deren Frauen; jedoch sei bemerkt, dass die Enthaltsamen die Mehrzahl—¾ der Mitglieder—bilden. Der Verband ist nach den einzelnen Eisenbahngesellschaften in 15 Distrikte eingeteilt, welche von einem Vorsitzenden und einem Sekretär verwaltet werden. Die Distrikte sind in Ortsgruppen eingeteilt. An der Spitze des Verbandes steht ausser dem Präsidenten Hills, der Generalsekretär Mr. Ward Bateson, London. Die Mitteilung, dass Mr. Bateson im vergangenen Jahre über 100 Vorträge in öffentlichen Versammlungen hielt, und ungefähr 35,000 Kilometer auf der Eisenbahn im Dienste des Verbandes zurücklegte, gibt uns ein ungefähres Bild von der Tätigkeit des Generalsekretärs. Das Organ des Verbandes " On the line " erscheint monatlich in einer Auflage von 14,000 Examplare. Auf die Zeitschrift muss besonders abonniert werden. Hierdurch erklärt sich auch der Umstand, dass die Zeitschrift bei einer Verbandsmitgliederzahl von 58,000 in einer Auflage von nur 14,000 Exemplaren erscheint. Dafür aber wird die schriftliche Propaganda durch Verteilung von Broschüren und Flugschriften desto eifriger betrieben. Die Versammlungen finden monatlich statt, bei welchen viel geredet wird. Für die Beibehaltung der Mitglieder und Anwerbung von neuen Mitgliedern wird viele Mühe aufgewendet. So bestehen beim Verbande verschiedene Fussballklubs, Gesangvereine,

Theatervereinigungen, u. s. w. Auch werden öfters gemeinsame Ausflüge veranstaltet, wobei photographische Aufnahmen sehr beliebt sind. Es haben sich daher verschiedene Reiseklubs gebildet. Bei grösseren Reisen hat der Zentralvorstand die Leitung. An diesen Reisen kann jedes Mitglied teilnehmen. Im vorigen Jahre wurde eine Reise nach der Schweiz unternommen, woran 60 Personen teilnahmen. Interessant ist die Art und Weise, wie die Mitglieder der einzelnen Distrikte zur Werbearbeit angespornt werden. Für diesen Zweck besteht hauptsächlich ein Wanderpreis, ein prächtig aus Silber gefertigtes, mit verschiedenen Verzierungen und Medallions, wie Porträt des Präsidenten Hills, etc., versehenes Bild. Dieses Bild bleibt 12 Monate im Besitz desjenigen Distrikts, welcher im vergangenen Jahre die meisten neuen Mitglieder angeworben hat.

In Finnland, wo die Enthaltsamkeitsbewegung bekanntlich glänzende Resultate erzielt hat, ist der Alkoholgenuss während des Dienstes nicht untersagt, aber es besteht die Bestimmung, dass jeder Eisenbahner, welcher im Dienst betrunken anbetroffen wird, sofort zu entlassen ist. Ferner hat die Eisenbahnverwaltung bekannt gemacht, dass jeder, welcher sich um eine Anstellung bei der Eisenbahn bemüht, ein Zeugnis vorzulegen hat, ob er abstinent ist oder nicht. Dies hindert die Verwaltung jedoch nicht, auch Nicht-Abstinente anzustellen, wenn der Bewerber im Uebrigen geeignet ist und einen ordentlichen Lebenswandel führt. Auf einigen grösseren Bahnhöfen, namentlich wo Werkstätten vorhanden sind, gibt es alkoholfreie Kantinen. Ob Eisenbahnunglücksfälle auf Alkoholgenuss zurückzuführen sind, lässt sich nicht mit Bestimmtheit sagen, da bei den Untersuchungen auf diese Frage kein Gewicht gelegt ist.

Der Eisenbahner-Abstinenten-Verein Finnlands, am. 21. September 1902 gegründet, hatte 1902, 300; 1903, 338; 1904, 609; 1905, 685; 1906, 976; 1907, 1,157; 1908, 915; 1909, 905; 1910, 929; 1911, 1,077; und am 1. Januar 1912, 1,100 Mitglieder; derselbe nimmt nur enthaltsame Eisenbahner, und deren Frauen und Kinder (über 16 Jahre) als Mitglieder auf; abstinente Nichteisenbahner können sich dem Verein als Teilnehmer anschliessen. Der Beitrag beträgt 1 M., für Familienmitglieder 20 Pfg., Aufnahmegebühr 20 Pfg. Die sogenannten steuerfreien, nicht mehr als 2 Prozent Alkohol enthaltenden Getränke dürfen getrunken werden. Der Verein erhält vom Staat 800 Mark jährlich, 2 Extra-Freischeine für alle bediensteten Mitglieder, 4 Extra-Freischeine für die Vorstandsmitglieder und auch Extra-Freischeine zum Besuch der Vorträge des Vereins.

Die Vereinszeitung "Viesti" erscheint in 1,500 Exemplaren, 8 Seiten stark, gross Format, monatlich und wird unentgeltlich an alle Mitglieder, an alle Bahnhöfe, und an die Vorgesetzten verteilt. Für weitere Aufklärung sorgen Wanderredner des Centralvorstandes. Vorsitzender des Vereins ist Herr Thuse Blassar, Tammisuo.

Aus Frankreich wird uns folgendes berichtet:

Während des Dientes ist es dem Personal verboten, Restaurants oder Cafés zu besuchen. Alkoholfreie Kantinen, die nur für das Personal bestimmt sind, gibt es nicht; jedoch werden während des Sommers unter dem Personal Extrakte zur Bereitung alkoholfreier Getränke verteilt. Abstinente werden bei der Anstellung und Beförderung nicht bevorzugt.

Der französische Verein (Société antialcoolique des Agents de Chemins de Fer Français, Paris, Rue Lazare, 43) ist im Jahre 1903 gegründet, ist jährlich um 3,500 Mitglieder gewachsen, und zählt jetzt 4,800 Mitglieder in 76 Sectionen. Es werden sowohl Mässige als Abstinente aufgenommen, Männer und Frauen. Die Verwaltungen der grossen Eisenbahngesellschaften geben, unter der Form des Abonnements auf die Zeitschrift des Vereins (La Santé de la Famille) eine Subvention von etwa 2,500 Francs. Der Mitgliedsbeitrag beträgt 1.25 Francs. Eine grosse Reihe von Bestrafungen, und Entlassungen sind auf Trunkenheit im Dienst zurückzuführen.

Im Falle des Todes eines Mitgliedes zahlt der Verein den Hinterbliebenen 500 Francs, und was besonders interessant ist, bei der Geburt des ersten Kindes 40 Francs, des zweiten 50 Francs, des dritten 60 francs, aber nur für den Fall, dass die Mutter das Kind selbst nährt; ein besonderes Damen-Comité ist für diesen Wohlfahrtszweig eingesetzt.

Vorsitzender ist M. Beauchamps, Paris.

In Holland ist dem Personal nur der Schnapsgenuss verboten. Bier ist gestattet. Besondere Einrichtungen für Ausgabe alkoholfreier Getränke existieren in Holland nicht. Der Holländische Verein enthaltsamer Eisenbahner (Vereeniging van Geheelonthonders onder Nederl. Spoor- en Trammeveg personeel), gegründet am 28 März 1909, mit 45 Mitgliedern, zählte 1910, 167; 1911, 380, und August 1912, 465 Mitglieder; derselbe nimmt nur Enthaltsame auf; Gönner gelten nicht als Mitglieder. Seit 1912 werden auch Frauen als stimmberechtigte Mitglieder aufgenommen. Die Verwaltungen geben einen Jahresbeitrag von etwa 800 Mitgliedern. Die ausgezeichnet redigierte Vereinszeitung (Het Veilig Spoor, Redakteur: H. A. Van Der Horst, Utrecht, Vandelhade, 22) erscheint in einer Auflage von 3.000 Exemplaren. Vorsitzender des Vereins ist G. A. Kinker, Utrecht, Joh. de Behastratt, 39, II.

In Norwegen verbietet ein Paragraph der Dienstvorschriften den Genuss berauschender Getränke während des Dienstes. Die Abstinenten werden bei der Anstellung offiziell nicht bevorzugt, jedoch ist es den Bemühungen der Enthaltsamkeitsvereine gelungen, dass einige Chefs den Enthaltsamen den Vorzug geben.

Besondere Ausschankstellen für alkoholfreie Getränke scheint es in Norwegen nicht zu geben.

Der norwegische Verein enthaltsamer Eisenbahner (Norske Iernbanemands Avholdsforbund), gegründet am 29. Januar 1893, mit 33 Mitgliedern, zählte am 1. Januar 1912, 626 Mitglieder. In den Jahren 1894–1910 waren die Mitgliedszahlen folgende: 155, 164, 207, 225, 249, 220, 230, 200, 180, 161, 170, 196, 241, 382, 432, 557.

Als Mitglieder werden nur Abstinente aufgenommen (Beitrag 1 Krone jährlich). Die Frauen werden nur als passive Mitglieder zugelassen und bezahlen keine Beiträge. Der Verband ist in 14 Ortsgruppen geteilt: 2 Verbände von Privatbahnen werden vom Central-Vorstande direkt verwaltet.

Unterstützungen erhält der Verein von den Staatseisenbahnen, 600 Kronen; von dem Ministerium, 400 Kronen; von den Hovedbahnen, 250 Kronen.

Vereinsorgan ist das Norsk Iernbaneavholdsblad, Redakteur und zugleich Vorsitzender des Vereins ist Herr Kontorist Eggebretsen, Christiania.

Besondere, durch Alkoholismus hervorgerufene Eisenbahnunglücksfälle sind in Norwegen bisher nicht vorgekommen.

Die Bahnofswirtschaften in Norwegen:

Die Gemeinden, in denen Stationen liegen, bestimmen, ob auf den Bahnhöfen ein Ausschank stattfinden soll oder nicht. Der Ausschank von Brantwein ist meines Wissens auf keiner Station Norwegens gestattet. Wein und Bier darf dagegen auf den meisten Bahnhöfen verabfolgt werden, doch nur an Reisende, und nur zu der Zeit, wo Züge kommen und gehen.

Aber da wie gesagt, die Kommune selbst bestimmt, ob ein Ausschank stattfinden darf, so gibt es eine recht grosse Anzahl von Bahnstationen, auf denen man zu keiner Zeit alkoholische Getränke bekommen kann.

Bei den Schwedischen Staatseisenbahnen gelten folgende Bestimmungen:

Bei Anstellung des Dienstpersonals wird stets auf Zeugnisse über Nüchternheit grosses Gewicht gelegt.

In der Regel wird kein Gewicht darauf gelegt, ob ein Aspirant Guttempler ist oder anderen Antialkoholsvereinen angehört; natürlicher Weise würde solche Rücksichtnahme nur zu einem momentanen Anschluss an derartige Vereine führen, ohne entsprechende Realität.

Extra (provisorisch) Angestellte, welche bei Betrunkensein ertappt werden, werden gewöhnlich sofort verabschiedet. Fest angestelltes Personal wird für Trunkenheit im Dienst, wie ausser Dienst bestraft: Beim ersten Mal mit 10tägigem Abzug des Gehalts, beim Zweiten Mal mit 1 Monat Suspension, beim dritten Mal mit Abschied. (Zuweilen greift man zu Degradirung und Lohnherabsetzung erst beim dritten Male der Betrunkenheit.) Abschied auf Grund von Trunksucht kommt nicht besonders oft vor.

Das Dienstreglement verbietet allem Personal, im Dienst Spirituosen mitzuführen oder zu geniessen.

Die der Eisenbahn gehörenden Restaurants sind so geordnet, dass spirituose Getränke daselbst durchaus nicht verkauft werden dürfen. An Sonntagen darf sogar Bier nicht anders als zum Essen serviert werden. Eine Ausnahme machen ein paar ältere Eisenbahnhotels, welche auf dem Bahnterritorium liegen. In den Restaurants der Bahn ist strenge Aufsicht. Alle haben auch die Verflichtung, Esswaren zu moderaten Preisen für das Bahnpersonal feil zu halten.

Besondere Vorschriften für das Dienstpersonal der Bahn rücksichtlich Aufenthalt in den Restaurants gibt es nicht, weil keine Spirituosen serviert werden dürfen.

Nachtlogis für das Zugpersonal ist seitens der Bahn angeordnet an den grösseren Knotenpunkten; an manchen Stellen sind bequeme, systematisch eingerichtete Häuser hierfür gebaut, an andern Stellen sind nur Lokale gemietet. Diejenigen, welchen kein Logis angewiesen werden kann, bekommen reichliches Einquartierungsgeld. Die Erfahrung hat gelehrt, dass das Ueberliegen bald hier bald dort grosse Gefahr für das Personal mit sich führt, und dass dieser Punkt viel grössere Aufmerksamkeit erfordert. Es gibt bei der Bahn eine grosse Anzahl "Extra-Bremser," welche leider bis jetzt noch keiner besonderen Aufsicht unterliegen während ihres beständigen Uebernachtens auf fremden Stationen.

Die Versuchung, freie Zeit in Bierkneipen und schlechten Lokalen zuzubringen und daraus folgendem Verschleudern von Geld und Kräften ist gross.

Ueber den schwedischen Verein enthaltsamer Eisenbahner (Iärnwägsmännens Helnykterhetsförbund) entnehmen wir einer interessanten, hübsch illustrirten, von Carl Loven verfassten Schrift die folgenden Angaben:

In einem Lande wie Schweden, wo die Abstinenzbewegung so stark entwickelt ist, war ein engerer Zusammenschluss der abstinenten Eisenbahner selbstverständlich. Vom Jahre 1890 an begegnen wir hier und dort kleinen Gruppen von abstinenten Eisenbahnern, die gewöhnlich als Guttempler-Logen auftreten. Aber diese Vereine hatten keinen Zusammenhang untereinander.

Am 25. Oktober 1900 veröffentlichte die Zeitschrift der schwedischen Eisenbahner "Das Signal" einen Aufruf zugunsten eines schwedischen Vereins abstinenter Eisenbahner. Am 1. Dezember 1901 wurde der Verein in Södertelje gegründet. Er zählte damals nur 20 Mitglieder, aber die Zahl stieg bald sehr schnell. Am 31. Mai 1903 zählte der Verein 1,631 Mitglieder, zur selben Zeit 1905, 2,804; 1907, 3,688; 1909, 4,196; 1911, 4,597 in 115 Ortsgruppen. Die Gesamteinnahmen des letzten Jahres beliefen sich für den Zentralverein auf 7,525 Kronen (eine schwedische Krone=1.10 Mark ungefähr).

Der Verein verdankt seinen raschen Fortschritt vor allem der Sympathie der oben genannten Zeitung "Das Signal" und der freundlichen Haltung der Berufsvereine des Personals, die den Bestrebungen der abstinenten Eisenbahner wohlwollend gegenüber standen, ohne ihnen jemals den passiven Widerstand zu leisten, wie man es in andern Ländern gewohnt ist. Diese Tatsachen kann niemanden überraschen, der je einmal durch Schweden gereist ist; das freundliche Entgegenkommen der schwedischen Eisenbahner ist über alles Lob erhaben und man hat den Eindruck, es mit Elitemenschen zu tun zu haben, die einer Bewegung, die ihr geistiges und leibliches Wohl im Auge hat, nicht gleichgültig gegenüberstehen können.

Der schwedische Verein abstinenter Eisenbahner hat durch sein Zentralkomite, wie durch die verschiedenen Ortsgruppen im Laufe der 10 Jahre seiner Existenz eine sehr grosse Tätigkeit entwickelt. Erwähnung verdient im Jahre 1909 die Veröffentlichung von 12 Serien Flugblätter, die zu 125,000 Exemplaren gedruckt und gratis verteilt worden sind. Ebenfalls hat der Verein die schöne Marmorgruppe von Jacopin: "Der Zahltag," als Lichtdruckbild herstellen lassen. Es wurden davon 2,500 Exemplare abgezogen und dank des guten Willens der Verwaltungen konnte es in einem massiven Rahmen in allen Wartesälen der schwedischen Eisenbahnen aufgehängt werden.

Von der Idee durchdrungen, dass der Gesang ein wesentliches Hilfsmittel zur Belebung der Sitzungen sei, haben die schwedischen Eisenbahner ein Gesangbuch herausgegeben, das von allen Sektionen sehr geschätzt wird. Sie haben ebenfalls eine sogenannte Agitationsmarke herausgegeben, die dazu bestimmt ist, den Verein bekannt zu machen und ihm zu gleicher Zeit Eisenbahner zuzuführen. Diese Marke ist zu 200,000 Exemplaren hergestellt worden.

Die schwedischen Eisenbahnverwaltungen, wenigstens einige unter ihnen, haben ihr Interesse für die Vereinsbestrebungen in klingender Form durch Ueberweisung grösserer oder kleinerer Beiträge bezeugt. Im Jahre 1909 endlich bewilligten die Regierung und die Schwedischen Kammern unseren Kameraden eine Unterstützung von 2,000 Kronen, die seither jährlich wiederholt wurde.

Aus Anlass eines Jubiläums hat der schwedische Verein abstinenter Eisenbahner verschiedene hohe Beamte darüber angefragt, ob nach ihrer Ansicht der Verein dazu beigetragen hat, die Nüchternheit unter dem Personal der schwedischen Eisenbahner verbreiten zu helfen. Daraufhin erhielt er viele ermutigende Antworten. Wir heben aus den vielen nur diejenige eines höheren Betriebsbeamten heraus, die besagt, dass die steigende Nüchternheit unter dem schwedischen Personal zu einem grossen Teil der Tätigkeit des Abstinenzvereins des Personals zu verdanken ist.

Der schwedische Verein gedenkt nicht auf seinen Lorbeeren auszuruhen, sondern mit grösserem Eifer als je den begonnenen Kampf weiter zu führen und so zu seinem Teile mitbeizutragen an der allgemeinen schwedischen Bewegung gegen den Alkoholismus, die Schweden an die Spitze aller europäischen Völker stellt, die den Kampf gegen den Alkoholismus unternommen haben.

Der jetzige Präsident des schwedischen Vereins abstinenter Eisenbahner ist Herr C. J. Svensson in Malmö; der Sekretär ist Herr Carl Loven, gleichfalls in Malmö.

Ausser den oben erwähnten 2,000 Kronen wurden dem Verein von Der Vereinigung der Privatbahnen, 500 Kronen; verschiedenen Privatbahnverwaltungen, 50–150 Kronen; Schwed. Eisenbahn-Verband, 500 Kronen bewilligt.

Der Genuss von Schwachbieren (2¼ Prozent) ist den Mitgliedern gestattet.

Einige Eisenbahnunglückfälle sollen auf Alkoholgenuss zurückzuführen sein.

In der Schweiz sind an folgenden Stellen alkoholfreie Kantinen vorhanden: (1) Auf den Bahnhöfen Basel, Bern, Olten, Luzern, Zürich, Winterthur, St. Gallen und Romanshorn; (2) in den Reparatur-Werkstäten Biel, Olten, Zürich und Chur.

Ausserdem ist noch folgende Verfügung bemerkenswert:

Abgabe von warmen Getränken und Erfrischungen an das beim äussern Dienst beschäftigte Personal der Schweizer Eisenbahnen.

Diesbezüglich hat die Kreisdirektion II an die betreffenden Dienststellen folgende Vorschriften erlassen:

I. ABGABE WARMER GETRÄNKE.

1. Während andauernder Kälte unter 5 Grad Celsius unter Null werden dem beim äussern Dienst beschäftigten Personal warme Getränke auf Rechnung der Verwaltung abgegeben.

2. Zum Bezuge sind berechtigt—

Beim Bahndienst das bei besonders strengen Arbeiten, bei ausserordentlichen Schneeräumungen, bei Schneeflugfahrten ausserhalb des Domizils und dergleichen beschäftigte Personal;

Beim Expeditions- und Zugdienst das beim äussern Dienste der Bahnhöfe und der Stationen I. Klasse beschäftigte Personal und das Personal der Güterzüge;

Beim Fahn- und Werkstättedienst das Lokomotivpersonal der Güterzüge, das beim äussern Dienst der Depots beschäftigte Personal, ferner das zu ausserordentlichen Arbeiten ausserhalb der Werkstätte verwendete Werkstättepersonal.

3. Die warm abzugebenden Getränke sind Suppe, Kaffee, Tee, Schokolade.

Alkoholische Getränke sind ausgeschlossen.

Der Preis der einzelnen Portion soll 25 cents nicht übersteigen.

Jeder bezugsberechtigte Angestellte hat Anspruch auf 2 Portionen täglich, sofern der äussere Dienst oder die ausserordentliche Arbeit mehr als einen halben Tag dauert.

4. Die Abgabe der Getränke erfolgt gegen Kontrollmarken durch die Speiseanstalten der Bahn, wo keine solche bestehen, durch die Bahnhofswirtschaften und in Ermangelung solcher durch hierfür besonders zu bestimmende Wirtschaften. Bei Arbeiten auf der offenen Linie soll die Abgabe der Getränke, wenn möglich, in einem in der Nähe gelegenen gedeckten Raume stattfinden.

5. Die Anordnung der Getränkabgabe, die Bestellung des Getränkes und die Abgabe der Kontrollmarken an die Bezugsberechtigten liegt den Bahnmeistern, den Bahnhofsvorständen und Stationsvorständen I. Klasse und den Depotchefs je für das ihnen unterstellte Personal ab.

6. Die in Ziffer 5 genannten Dienststellen führen über die Getränkeabgabe genaue Rechnung, die nach Ablauf der Abgabeperiode der vorgesetzten Dienstabteilung ohne Verzug einzureichen ist.

Für Gemeinschaftsstationen und Gemeinschaftsstrecken hat eine genaue Ausscheidung der auf Gemeinschaftsrechnung fallenden Abgaben stattzufinden.

Bei den Arbeiten des Bahndienstes erfolgt die Verrechnung zu Lasten der ausgeführten Arbeit.

7. Die Lieferanten der Getränke dürfen gegen die Kontrollmarken einzig die vorgeschriebenen Getränke abgeben. Sie haben die eingelösten Kontrollmarken täglich der Dienststelle, welche die Abgabe der Getränke verfügt hat, gegen Quittung zurückzustellen.

8. Die Kontrollmarken sind von den Dienstabteilungen bei der Materialverwaltung zu beziehen.

II. ABGABE VON ERFRISCHUNGEN.

Ohne Rücksicht auf die Jahreszeit erfolgt die Abgabe von Erfrischungen an das Personal zu Lasten der Verwaltung bei ausserordentlichen Arbeiten infolge von Betriebsstörungen, Entgleisungen, Hochwasser u. dergl., besonders bei solchen Arbeiten während der Nacht, je nach den Umständen des einzelnen Falles.

Die Anordnung und Verrechnung der Abgabe ist Sache des die Arbeiten leitenden Vorgesetzten. Für die Verrechnung gelten die Bestimmungen unter I, 6.

Ein Alkoholverbot existiert nicht in der Schweiz, auch werden die Abstinenten nicht bei der Anstellung bevorzugt.

Der Schweizer Verein abstinenter Eisenbahner, 1902 gegründet zählt jetzt etwa 600 Mitglieder; 1902, 148; 1903, 273; 1904, 375;

1905, 418; 1906, 495; 1907, 495; 1909, 550; 1910, 541; 1911, 561 Mitglieder.

Als Mitglieder werden nur Abstinente aufgenommen, jedoch hat der Aufnahme eine Probezeit von mindestens 1 Monat vorauszugehen, während welcher der Kandidat enthaltsam sein muss. Gönner des Vereins zahlen einen Mindestbeitrag von 5 Francs, der Mitgliedsbeitrag beträgt 2 Francs, ausserdem ein Eintrittsgeld von 2 Francs.

Es gewährten Unterstützungen: (1) die Schweizer Bundesbahnen, 500 Francs; (2) die Rhätischen Bahnen, 500 Francs; (3) der Verband schweizer Sekundärbahnen, 300 Francs. Ausserdem erhalten die einzelnen Sectionen von den Kantonregierungen, 2,000 Francs.

Das Vereinsorgan sind die Schweizer Abstinenzblätter (für die deutsche Schweiz) und L'Abstinence (für die französische Schweiz).

Degradierungen und Entlassungen wegen Trunkenheit im Dienst sind öfters vorgekommen, eine zuverlässige Statistik über diese Fälle besteht jedoch nicht.

Vorsitzender des Vereins ist Herr Karl Weber, St. Gallen, Greifenstrasse, 14.

Der ungarische Handelsminister hat im Interesse der Sicherheit des Eisenbahndienstes den im Betriebe tätigen Angestellten der Staatsbahnen den Genuss alkoholischer Getränke während des Dienstes verboten. Auch soll nach Anordnung des Ministers strenge darauf geachtet werden, dass niemand in angetrunkenem Zustande den Dienst antritt.

Völlige Abstinenz hinsichtlich alkoholischer Getränke verlangt Canada. In Indien, China, Japan und Australien gibt es keine Temperenzvereine für Bahnangestellte, jedoch ist in Australien dem Personal der Besuch der Wirtschaften verboten. Auch in Neu-Seeland bestehen sehr strenge Bestimmungen. Anlässlich eines vor einigen Jahren in Neu-Seeland gehaltenen Eisenbahn-Kongresses hat Sir Joseph Ward alle Eisenbahn-Wirtschaftslizensen mit Ablauf der betr. Verträge aufgehoben. Jetzt sind weder in den Bahnhofsbüffets, noch in den Speisewagen des ganzen Staatsgebietes alkoholische Getränke erhältlich.

Ueber Amerika bringe ich keine Daten, da über die dortigen Verhältnisse von anderer Seite berichtet werden wird.

Ich bin mir sehr wohl bewusst, dass das vorliegende Material nicht vollständig ist, es fehlen verschiedene Länder; für Uebermittlung weiteren Materials würde ich sehr dankbar sein.

LEGAL PROVISION FOR RESTRICTION OF ALCOHOLISM AMONG EMPLOYEES OF COMMON CARRIERS IN THE UNITED STATES.

Prof. Reid Hunt, United States Public Health Service.

More than 30 States, the Canal Zone, and Porto Rico have laws restricting the use of alcoholic beverages by railway employees; many of these laws date from 1890 or earlier. In several States similar laws exist in regard to electric railways and to street cars, whether propelled by electricity or drawn by horses. A smaller number of States, about 9, have similar regulations in regard to the drivers of stage coaches, cabs, and other vehicles, and 6 have such laws relating to employees of steam and sailing vessels, canal boats, etc. California has a law relating to the use of alcohol by automobile and motorcycle drivers.

Among the classes of employees upon whom specific restrictions are laid in the different States are baggage-masters, brakemen, bridge tenders, conductors, train dispatchers, engineers, firemen, flagmen, signalmen, switchmen, and telegraph operators; in many cases the restrictions apply to all employees. In the case of boats, the captain and pilot are usually mentioned specifically; in the case of other vehicles, the driver or motorman is usually mentioned.

The most common form of restriction (24 States) is the making it a misdemeanor, punishable by fine or imprisonment, or both, for any of the employees to be intoxicated while engaged in the discharge of duties. In two or three States it is made a felony if any employee causes death or injury while intoxicated. In Michigan and Vermont the employment of anyone who uses intoxicating drinks as a beverage is forbidden. In some others (New York and Ohio), the employment of anyone addicted to their intemperate use is prohibited, and the railway is liable to a fine for employing anyone addicted to the excessive use of alcohol. The latter provision relating to the employment of drivers of coaches, cabs, and other vehicles, is in force in several States. The railway is frequently held specifically liable for all damages entailed by the negligence of an intoxicated employee.

Several States prohibit the drinking or the carrying of liquor on the locomotive cab or any other part of the train, except in a dining, buffet, or private car. The prohibition laws of several States prevent the sale of liquors on trains in those States.

It is well known that many railways have regulations of their own in regard to the use of alcohol by their employees; frequently the regulations antedate the laws. In order to obtain further information on this subject, letters were addressed to a number of railways operating in all parts of the United States. In all cases the replies indicated that these regulations are almost invariably, perhaps inva-

riably, more stringent than the legal requirement. The most frequent form of these regulations is as follows: "The use of intoxicants by employees while on duty is prohibited. Their use, or the frequenting of places where they are sold, is sufficient cause for dismissal." This seems to represent the minimum requirement on the part of most of the American railways. A number require total abstinence, both on and off duty, on the part of all employees charged in any way with the direction or operation of trains; in other cases, this rule applies to all of the employees. Other railway companies require total abstinence on the part of their employees when on duty, and state that preference is given to those who abstain from alcohol under all circumstances.

No distinction seems to be made by the American railways between malt and distilled liquors.

In many cases these rules have been operative for many years, and there is reason to believe that they are very generally enforced, especially in the case of those engaged in any way in the operation of trains.

THE PROTECTION OF RAILROAD PASSENGERS.

HENRY M. BRACKEN, M. D., Secretary and Executive Officer, Minnesota State Board of Health.

Under the head of protection of railroad passengers we are expected to deal with—

(1) Protection against disease.

(2) Protection, to some extent at least, against discomfort.

The passenger is constantly under some risk, so far as relates to communicable diseases, because of (*a*) conditions for which the traveling public are responsible, (*b*) conditions for which the railroad officials are responsible.

The traveling public spreads disease because of ignorance, indifference, or selfishness. Ignorance of the public, as it relates to communicable diseases, may be divided into excusable and nonexcusable. Excusable ignorance has to do with the unknown carrier; nonexcusable ignorance, with the known carriers, or with those who know they are ill but have not taken the trouble to find out the nature of their illness. Undoubtedly, many travelers are carriers of some one of the infectious types of disease without any reason to suspect the fact. Little, if anything, can be done to protect the public against these people. As this danger exists everywhere, we need not give it special consideration in discussing the dangers of railroad travel.

On the other hand, there are people who know that they are disease carriers, and yet they travel without taking any precautions whatever looking to the protection of others. These people represent one

group of travelers who are indifferent as to what others may suffer through their negligence or selfishness, or both.

Another group of indifferent and selfish people are those who travel while knowingly suffering from some disease such as measles, scarlet fever, diphtheria, whooping cough; or knowingly take children ill with one of these diseases on a railway journey.

The group of ignorant people who, knowing they are sick, do not take the trouble to find out the nature of their illness, has an illustration in the man who recently, feeling ill and even having an eruption, did not take the trouble to call a physician, but started on a long journey by rail to consult a world-renowned group of surgeons as to his illness. It was not until he had traveled on three distinct lines of railroads, exposing many people, both on trains and at transfer points, that he was recognized by a traveling health officer as a case of smallpox.

For the dangers thus far enumerated the railroad officials can not be held responsible, unless perhaps the position should be taken that a conductor or porter might at least suspect a case of smallpox or other eruptive disease and have a physician called to the train at the next station in order that the suspicion might be cleared up.

It is to health organizations that we must look for protection against all of the foregoing conditions. A well-organized health community should know of nearly all, if not all, of the patients suffering from a communicable disease, or of a carrier of a disease from which the patient is convalescing, and should prevent such an individual from traveling. It is for the people themselves to demand protection against such conditions and to insist on properly equipped and organized health authorities everywhere.

Railroad officials are responsible for some of the infections of passengers. When a railroad company takes the supply of drinking water for the cars or stations from a questionable source; when it furnishes the passengers with a common drinking cup; when it has toilet closets in stations or on trains unprotected from flies; when it permits swarms of the "typhoid fly" in its waiting rooms, dining rooms, and restaurants; when it carries a large number of "typhoid flies" on its trains, it is guilty, for it is endangering the lives of the traveling public. All of these sins of omission and commission are common with the railroad, on the American continent at least.

Let us consider specifically some of the dangers to which the traveling public is exposed, and let us begin with the fly. This filth carrier is everywhere during the summer months. It may be difficult to protect the stations, but if the station closets are properly constructed and cared for, if the stations are kept clean, if the breeding places for flies about the station are cut off, if the toilets and stations are properly ventilated and screened, if flytraps are provided, and if

the stations are properly policed, the fly nuisance will be reduced to a minimum.

As for trains, if the ordinary day coach is properly cared for it will not be oversupplied with flies. There is absolutely no excuse for the presence of flies on a vestibuled train, for this is (or should be) screened from one end to the other. Yet the fly is a common passenger on the trains de luxe in this country. Not long since I started westward from Chicago at 10 p. m. on one of the best transcontinental trains. The following morning there were flies everywhere on this vestibuled train—in the sleeping car, in the dining car—and yet there were screens on all of the windows and screen doors at either end of the dining car. Where did the flies come from? Surely not from the outside. They were on the train when it left Chicago at 10 p. m. They may not have been as dangerous from the typhoid-fever point of view as the outside fly, for they may have been train bred. Nevertheless, they had no business on the train. If a few flies board the train while in transit they should be disposed of at the cleaning yards; in fact, the few flies entering the train should be disposed of by the porters before reaching the terminal station. The condition above described is by no means exceptional. The fly nuisance on trains is constantly referred to by observing travelers. It was apparent on the "specially equipped limited train" on which I traveled from Chicago to this city last week. Who is to blame for such conditions? The railway company, through its officials, without doubt. All dining cars should have screen doors at either end, and in addition should, if necessary, have flytraps on the car platforms within the vestibule. More care should be given to the cars at the cleaning yards, and the train crews should be required to aid in keeping the train free from flies. Flies are a real source of danger on the train.

Much has been said of the dangers from the common drinking cup. These are real dangers, and should be guarded against on trains and in stations, but the so-called sanitary drinking fountain with a cup-like arrangement which holds the residue water from the last drinker is no improvement over the common drinking cup. In fact, it is worse, for with the cup the person drinking only touches the edge of the cup, while, with these faulty fountains, the person drinking actually puts the mouth, and sometimes even a part of the face, into the water that is left by the last person drinking. These faulty fountains are seen in many of our stations and in other public places. Much has been said about the dangers from excreta deposited on the roadbed. This is probably not a source of danger to the traveling public, unless through the flies that may pass from the excreta to the train, but it is a source of danger to the people by the roadside, either through fly or water infection, and should be suppressed.

Much has been said also about the danger of infection from the traveling consumptive. This has probably been overstated. The consumptive should, of course, not use a common drinking cup, and the sputum should be properly cared for. The careful consumptive is not going to spread disease while traveling, and all traveling consumptives should in this enlightened age be careful.

As to the discomforts of travel for which the railroad companies are responsible, some sanitarians of the present day would say we had nothing to do with such things. Yet some discomforts are directly associated with the spread of disease (the fly nuisance, for instance), while others, by lowering the resistance of the traveler, tend to favor infection. We are told that a badly ventilated car is not in itself a cause of disease, yet any careful observer knows that the physical condition of the traveler is influenced by the atmosphere of a stuffy car. We are told that the air of the closed lower berth is good, but many travelers have not only a sense of oppression and discomfort while sleeping in the closed lower berth, but experience actual sickness on the following morning—a sickness that would not have been present had the traveler slept in a well-aired room the night before. The so-called "fresh-air fiend" knows that a night's rest in the open is best; that a sleeping porch is next best; that the room with open windows is next best; that the closed sleeping room is undesirable; and that the closed lower berth is the limit for decent people as a sleeping place. Let those who have presented strong arguments against dangers from vitiated air in the lower berths of sleeping cars or the dangers from an excess of carbon dioxide, not stop with the destruction of our beliefs, but tell us what the real trouble is and then impress upon those responsible for the unsatisfactory conditions in the lower berths the need of securing a remedy.

While railroad officials have their share of responsibility in connection with the protection of the passengers, the whole burden must not be placed upon them. It is time for the people to awaken to a knowledge of their share. Public health of to-day is prevention rather than punishment. The people are the ones who reap the benefits of good sanitary laws. It is for them to demand the passage of such laws and then to assist in their enforcement.

THE NECESSITY FOR THE MAINTENANCE OF SANITARY DEPARTMENTS BY COMMON CARRIERS AND THE DUTIES THAT WOULD BE PERFORMED BY THOSE DEPARTMENTS.

Dr. ARTHUR M. HUME, Chief Surgeon, Ann Arbor Railroad, Owosso, Mich.

In the short paper that I shall present to you, nothing classical or savoring of scientific research or discovery will appear. I believe that conditions exist all over this and perhaps many other countries which are inimical to the health and well-being of its people. These

or similar conditions have existed almost from time immemorial, and to this day no adequate remedy has been devised or effectively applied.

Sanitation is defined as "the devising and applying of measures for promoting and preserving public health," and is the gospel of cleanliness. It teaches that hygienic salvation for mankind is found in clean air to breathe, clean water to drink, clean food to eat, and clean living of life.

The devising of health-promoting measures is, however, only one of the minor problems of sanitation; another—and often the greater problem—is the practical application of such measures to the abatement of existing unhealthful conditions. All of these problems have been met and studied and many of them successfully solved, so that modern invention has produced equipment and methods whereby there is now insured to house dwellers, even in the crowded large cities, a plentiful supply of good water, good air, reasonably clean food, and the removal of noxious waste and excreta; and he who is not a house dweller, but lives in the open, has but to help himself from nature's bountiful supply of all that man requires for his natural existence.

While science, humanitarianism, and legislation have thus furnished to the individual of all classes protection against disease-engendering conditions in both his home and occupational life, but little progress has been made in transportation sanitation.

Speaking more specifically of American conditions and of our larger railway lines, we may call this our "world on wheels." It is in railway coaches that a large percentage of our people live; there they eat and drink and sleep; some are born there and many die there. For many years these car dwellers have been demanding that their moving homes should have, at least, the sanitary necessities of the modern dwelling house, and most of our railway lines have been endeavoring to comply with such demands.

Modern methods and appliances quite positively insure to the 300 or 400 guests of the public house or hotel a plentiful supply of good air of proper temperature, good water, pure, well kept, and well prepared food, and a safe disposal of waste and excreta. Sanitary science has not yet solved the problems, however, of providing for the 300 or 400 occupants of a transcontinental railway train, flying across the face of the earth at 50 miles an hour, and subject to the greatest variations of altitude, temperature, climatic, and physical conditions, an always proper supply of good air, an always pure water to drink and pure food to eat, and particularly a proper method of waste disposal.

State legislatures and other lawmaking bodies have enacted laws requiring of common carriers better sanitary conditions, but with no thought or knowledge of the problems involved in the production of

those better conditions, and often demanding action which if complied with would make matters worse instead of better. Transportation companies have endeavored to comply with these requirements, but, proceeding by faulty methods, have been mainly successful only in expenditure of money. Wherein lies the blame for these bad conditions not corrected, and upon whom should rest the responsibility for this work not done?

No great civic reform has been attained or material progress made, except as a public sentiment that demanded something good, carried with it or supplied a practicable plan whereby the demand might be satisfied. That better sanitary conditions should prevail with our passenger transportation lines may be conceded without argument, but who is it that will recognize the obstacles in the way and set about overcoming them?

In the solution of these many problems there is a clear call for the specializing railway sanitarian—a man who has added to his scientific education and training a working knowledge of car building, roadway building, and maintenance, motive engineering and traffic operation. Without this special knowledge and training he is near helpless in railway sanitary work, but properly equipped he may be a power for progress. As an instance of what may be accomplished by the specialist, we may mention the advanced ideas of car ventilation adopted and successfully worked out by the Pullman Co. under the direction of its able superintendent of sanitation. That every transportation line of consequence must maintain a well-equipped sanitary department, in charge of a competent railway or marine sanitarian, is clearly a necessity if there is to be obtained for the common-carrier companies, for their patrons, and for all the people the largest measure of benefits at a minimum of cost.

Let us now consider some of the duties to be performed by the sanitary departments of common carriers, many of which would be largely administrative and in the line of a practical application of scientific methods.

Such departments should have supervision of water supply in stations and cars; air supply, heating and ventilation of cars and stations; food supply on dining cars and at eating stations; disposal of waste and excreta—a problem that has never yet been satisfactorily solved; cleaning and cleanliness of cars and stations; the prevention of car pollution by spitting, and of track and roadway pollution by excreta and improper drainage; transportation of diseased passengers (which every common carrier must at times accept) and the protection of the public therefrom. All of these duties and many others are those of the railway sanitarium, and their performance demands special knowledge and technique of operation.

No legislature can enact a safe and sane sanitary law, except as that law emanates from a body competent to deal with the problems involved; and no health law can be effectively enforced except through men or organizations competent to judge of the practicability of methods and the value of results. In order, therefore, that sanitary laws affecting interstate railway operation may produce good results, and in the absence of a legally established national health bureau or department, all railway sanitary laws should originate with the State board of health, be enacted by the proper lawmaking body of the State (or, as a Board regulation, be given the force and effect of law), and administered by the State health board.

There would yet remain the necessity that State and provincial boards of health should secure, by conference and cooperation, practically uniform sanitary regulations governing interstate railway operation, for in no other way can the work of these boards and of the railway sanitarian be made most effective.

FOOD, WATER, AND ICE SUPPLIES IN RAILWAY STATIONS AND RAILWAY TRAINS.

Dr. S. J. CRUMBINE, Secretary State Board of Health of Kansas, Topeka.

The history of the progress of civilization, particularly in the western half of the United States, would be incompletely written were not a large place given to the part that the great railway systems play in the settlement of the country and in the development of her agricultural and commercial interests. Perhaps no greater necessity of modern life in any of the civilized countries exists to-day than that of our present transportation companies, chief of which are the great railway systems, which touch almost every side and phase of our complex social and commercial life, and without which civilization would be set back a century.

It has usually been the case that all discoveries of general use have brought with them certain problems for solution, and the great common carriers have in like manner presented new problems to the sanitarians and conservationists which should engage the serious consideration and attention of all lovers of their fellows.

Formerly, when transportation was slow and difficult, epidemics of disease were not readily transmitted, but now it is a matter of common observation and knowledge that malignant epidemics of disease in any portion of our country are to a greater or less degree a menace to every other portion by reason of the easy and ready access through the great transportation lines.

It is not our intention in this paper to discuss the transmission of disease through the medium of the common carriers, but to speak of

some of the difficulties of the transportation companies in furnishing food and water supplies to the millions of passengers carried on their roads annually, and to point out, if possible, the sources of some of the danger which threaten the traveling public as well as to venture to suggest some remedies for these conditions.

We are told that one of the greatest problems confronting an army on the move is that of providing it with proper food and pure and wholesome water. Every great railway system in this country has every day such a problem on its hands, and to feed this army with properly prepared pure food and to furnish it with uncontaminated water in its dining cars and railway trains is a task of no mean proportions.

At the outset it should be noted that in the dining-car service the mechanical difficulties of the car itself are practically insurmountable, and thus ideals can not be established nor should they be expected. Food products are necessarily stored in compartments within a few feet of a red-hot range, and access to the source of supply of both food and water in many instances, and particularly in the desert country, is difficult indeed. It necessarily follows that, with these mechanical handicaps, the very best sanitary arrangement possible for the storing of food products should be designed in the car itself and the most scrupulous care given all departments by the manager in charge. In so far as possible all compartments should be made of material that can be readily and thoroughly sterilized by live steam. Removable shelves should be constructed of enameled ware or of some other nonabsorbent material, and the most careful daily inspection should be made of the entire car. During fly season all windows and doors should be carefully screened, and a special effort made before serving meals to rid the car of all flies that may have gained access thereto through open doors.

The practice of using the dining car as a sleeping room for employees is one that should be discontinued wherever possible, and it is the belief of the writer that much of the prevailing practice could be discontinued if an effort were made in that direction.

Moreover, the lack of space and crowded condition of the car should not be an excuse for using the refrigerator as a place for storing the street clothes and hand satchel of the chef or cooks, as has been found on occasion. Neither should the long distance from the base of supplies be a satisfactory excuse for the serving of tainted or spoiled meats, fowl, or fish, as has also been found on a number of occasions.

Since most of the States now have food and drugs laws, which carry with them provision for inspection of places where foods are prepared and served, the places above alluded to have been brought under State inspection, and there is no longer any reason why anything but reasonably sanitary conditions should exist.

It is argued that the dining-car service throughout the country is quite generally conducted at a loss to the company, and it is altogether likely that in the main that statement is true, yet it is a necessary part of the modern equipment, and the traveling public is entitled to have places where food products are prepared and served that are above any suspicion of unhealthful conditions. Servers of foods and drinks at railway eating houses and stations should be held to the strictest degree of accountability as to the purity and the wholesomeness of their wares, for the difficulties that apply to dining-car service do not obtain at those places; moreover, passengers ordinarily do not have the opportunity of choice as to foods that are served at such places, being compelled, as a rule, to take what is served them, which emphasizes the necessity of the strictest sanitary measures in the production, preparation, and serving of foods at railroad stations.

During the past few years the attention of health officers and of the public in general has been focused upon the quality and purity of the water served on railway trains and in other public places, as well as upon the method of dispensing such water to the public. From investigations made, the bacterial findings on public drinking cups have been of such a character as to condemn the public cup as being a menace to public health, and thus to-day the majority of the States have, through order or by enactment of law, caused to be abolished the public drinking cup on railway trains and in public coaches of their respective States. There yet remains the problem of the purity of the water ordinarily served on railway trains and in railway stations, and it is of this phase of the question that the Kansas State Board of Health has set itself to find a solution.

Early in May the writer requested Prof. N. P. Sherwood, of the University of Kansas, to secure a large number of samples of drinking water drawn direct from the coolers of trains operating in Kansas for examination as to potability. Prof. Sherwood's report is given as a part of this paper, and is as follows:

At the request of Dr. S. J. Crumbine, secretary of the Kansas State Board of Health, an examination of the drinking water on the trains that operate in or through Kansas was begun on May 23, 1912, at the Kansas City Union Station. A similar examination was made at Wichita on May 29 and 30. Fifty-five samples were taken at Kansas City from trains on the Frisco, Santa Fe, Missouri, Kansas & Texas, Rock Island, Missouri Pacific, Burlington, and Union Pacific Railroads. The samples were plated on plain agar immediately after collection, and a set of six fermentation tubes containing Jackson's lactose bile[1] were also inoculated. Five of these tubes were each inoculated with 1 cubic centimeter of the sample of water, and 10 cubic centimeters of the sample was planted into one large fermentation tube. This was done in order to determine approximately how many, if any, *B. coli* were present. These plates and tubes were then incubated for 24 hours at 37° C., and counts made.

There are present even in good drinking water a few harmless bacteria, the number varying largely with the source of supply. These harmless water

bacteria, however, thrive best at room temperature and are, as a rule, inhibited when incubated at 37° C., or body temperature.

Mathews,[2] in 1893, showed that in streams presumably exposed to pollution the count at 37° C. was in the neighborhood of 100 per cubic centimeter, while for unpolluted water from wells, springs, and taps the count was under 30 per cubic centimeter. Gage[3] has shown that for clean, unpolluted water the number of organisms developing at 37° C. is quite small, being as a rule under 50 per cubic centimeter, while for polluted water the count is high. Too much stress must not be laid upon the count alone, yet one can get some idea as to whether the water is at least clean or dirty by the number of bacteria developing at the body temperature.

For a long time bacteriologists considered that the character of a water could be determined by the number of bacteria developing on agar and gelatin. Eventually, bacteriologists realized that the quality or kind of bacteria present, as well as the quantity, is of prime importance. The customary qualitative test made on any sample of water is one to determine whether *B. coli* is present and, if so, in what quantity. A test is made for this particular intestinal organism because if it is present it is easily found and identified, and since it is a normal inhabitant of the colon or large intestine of warm-blooded animals it indicates, when present in sufficient quantity—i. e., one per cubic centimeter or more—pollution with animal waste. In England, where the sewage is much more concentrated than in America, sewage streptococci are looked for in a water examination instead of *B. coli*. The English argue, with reason, that the sewage streptococci are more delicate than *B. coli*, and hence their presence in a water is a certain indication of recent sewage pollution. In these examinations streptococci were looked for, as well as *B. coli*. Daniel D. Jackson, in Journal of Infectious Diseases, March, 1907, defines *B. coli* as an organism capable of fermenting both dextrose and lactose with the production of CO_2 and hydrogen, which does not liquefy gelatin in 14 days, and which is morphologically a rod.

It is a well-known fact that ordinary ox bile has an inhibitive action on the majority of bacteria outside of those belonging to the typhoid and colon groups; also that comparatively few organisms outside the colon group ferment lactose. Hence lactose bile—ordinary ox bile to which has been added 1 per cent peptone and 1 per cent lactose—is a medium made use of in examining a water for *B. coli*. Measured quantities of water are added to fermentation tubes containing lactose bile, and if *B. coli* is present the lactose will be fermented and CO_2 and hydrogen will be given off. When gas showed up in any of the fermentation tubes, confirmatory tests were made to see whether it was *B. coli* or some other organism that was causing the fermentation. As a rule, in about 90 per cent of the cases *B. coli* will be found to be the active agent. Streptococcus pyogenes was finally identified by its characteristic growth on blood agar. As a general thing, only one sample was taken from each train, and that was collected from the chair car next to the smoker.

The results of the work done at Kansas City, Mo., and at Wichita, Kans., are shown in the tables following.

Sample No.	Train No.	Name of railroad.	Time.	Train arriving or departing.	Date, 1912.	Bacteria per cubic centimeter on agar at 37° C., 24 hours.	Gas in lactose bile. Fermentation tube No. (1 cubic centimeter)— 1	2	3	4	5	6	10 cubic centimeters confirmatory test.	Approximate number *B. coli* per 10 cubic centimeters.	Remarks.
			p. m.												
1	102	Frisco	5.00	A.	May 23	100	−	−	−	−	−	−	−	None.	
2	125	....do	5.05	D.	...do....	150	−	−	−	−	−	−	.....	None.	
3	10	Atchison, Topeka & Santa Fe	5.05	D.	...do....	650	+	−	−	−	−	+	.....	None.	
4	24	Missouri, Kansas & Texas	5.05	A.	...do.....	300	−	−	−	−	−	−	.....	None.	
5	12	Rock Island	5.10	A.	...do.....	1,400	−	−	−	−	−	−	.....	None.	
6	29	Missouri, Kansas & Texas	5.30	D.	...do.....	250	−	−	−	−	−	−	.....	.....	
7	1317	Frisco	5.35	D.	...do.....	850	−	−	−	−	−	−	.....	.....	
8	1	Missouri Pacific	6.00	D.	...do.....	1,200	+	−	−	−	−	+	+	2	
9	39	Rock Island	6.10	D.	...do.....	200	−	−	−	−	−	−	.....	.....	
10	106	Missouri Pacific	6.15	A.	...do.....	400	−	−	−	−	−	+	+	1	
11	105	Frisco	6.15	D.	...do.....	750	+	+	−	−	−	+	+	4	
12	119	Missouri Pacific	6.20	D.	...do.....	800	+	+	−	−	−	+	+	4	
13	43	Burlington	6.35	D.	...do.....	500	−	−	−	−	−	−	−	None.	
14	111	Frisco	9.10	D.	...do.....	500	−	−	−	−	−	+	+	1	
15	11	Atchison, Topeka & Santa Fe	9.25	D.	...do.....	650	+	−	−	−	−	+	+	2	
16	36	Rock Island	9.45	A.	...do.....	250	−	−	−	−	−	−	.....	None.	
17	103	Missouri Pacific	9.50	D.	...do.....	300	−	−	−	−	−	−	.....	None.	
18	17	Atchison, Topeka & Santa Fe	10.00	D.	...do.....	800	−	−	−	−	−	−	.....	None.	
19	21	Misouri, Kansas & Texas	10.00	D.	...do.....	950	+	+	−	−	−	+	+	4	
20	112	Missouri Pacific	10.20	A.	...do.....	150	−	−	−	−	−	−	.....	None.	
21	203	Atchison, Topeka & Santa Fe	10.45	D.	...do.....	1,100	−	−	−	−	−	−	.....	None.	
22	1	Rock Island	11.15	D.	...do.....	800	+	+	+	−	−	+	.....	6	
23	23	....do	11.30	D.	...do.....	250	−	−	−	−	−	−	.....	None.	
			a. m.												
24	25	Missouri, Kansas & Texas	2.20	D.	May 24	1,500	−	−	−	−	+	+	+	1	
25	210	Missouri Pacific	2.00	D.	...do.....	40	−	−	−	−	−	−	.....	None.	
26	23	Rock Island	6.15	A.	...do.....	250	−	−	−	−	−	+	+	1	*Streptococcus pyogenes* present also.
27	8	Atchison, Topeka & Santa Fe	6.30	A.	...do.....	700	−	−	−	−	−	+	−	None.	
28	18	....do	7.00	A.	...do.....	550	−	−	−	−	−	−	.....	None.	
29	12	....do	7.10	A.	...do.....	650	−	−	−	−	−	−	.....	None.	
30	104	Frisco	7.00	A.	...do.....	200	−	−	−	−	−	−	.....	None.	
31	22	Missouri, Kansas & Texas	7.20	A.	...do.....	300	−	−	−	−	−	−	.....	None.	
32	35	Rock Island	7.55	D.	...do.....	1,000	+	+	−	−	−	+	−	None.	*B. mycoides.*
33	113	Atchison, Topeka & Santa Fe	8.01	D.	...do.....	600	−	−	−	−	−	−	.....	None.	
34	107	Union Pacific	8.05	D.	...do.....	1,100	−	−	−	−	−	+	+	1	*Streptococcus pyogenes* present.
35	111	Missouri Pacific	8.15	D.	...do.....	1,000	+	+	+	+	−	+	+	8	
36	127	Frisco	8.30	D.	...do.....	30	−	−	−	−	−	−	Bubble.	None.	*B. mycoides.*

37	201	Atchison, Topeka & Santa Fe	9.00	D.	...do	150	−	−	−	−	−	−		None.	
38	3	.....do	9.10	D.	...do	1,200	+	+	+	−	−	+	+	6	
39	110	Union Pacific	9.15	A.	...do	1,800	+	+	+	+	+	+	+	10	
40	102	Missouri Pacific	9.20	A.	...do	700	+	+	+	−	−	+	+	6	
41	5	Atchison, Topeka & Santa Fe	9.40	D.	...do	100	−	−	−	−	−	−		None.	Chair car, last.
42	112	Frisco	7.59	A.	...do	1,250	−	−	−	−	−	+	+	1	
43	9	Atchison, Topeka & Santa Fe	9.20	A.	...do	950	+	+	+	−	−	+	+	6	
44	11	Rock Island	10.10	D.	...do	500	−	−	−	−	−	−		None.	
45	110	Atchison, Topeka & Santa Fe			...do	400	−	−	−	−	−	−		None.	Smoking car.
46	110	.....do	10.10		...do	500	−	−	−	−	−	+	* +	1	Chair car.
47	110	.....do	10.10		...do	900	−	−	−	−	−	+	+	1	Do.
			p. m.												
48	531	Missouri Pacific	4.05	D.	...do	75	−	−	−	−	−	−	−	None.	
49	105	Union Pacific	4.10	D.	...do	1,200	−	−	−	−	−	−	−	None.	
50	1316	Frisco	4.15	A.	...do	90	−	−	−	−	−	−		None.	
51	111	Atchison, Topeka & Santa Fe	4.15	A.	...do	1,200	−	−	−	−	−	−		None.	
52	109	.....do	4.30	A.	...do	800	−	−	−	−	−	−		None.	
53	131	Missouri Pacific	4.30	D.	...do	850	−	−	−	−	−	+	−	None.	
54	5	Atchison, Topeka & Santa Fe	9.40	D.	...do	30	−	−	−	−	−	−		None.	Do.
55	5	.....do	9.40	D.	...do	25	−	−	−	−	−	−		None.	Smoking car.
		Tap			...do	20	−	−	−	−	−	−		None.	
		SANDS SPRING WATER USED IN UNION PACIFIC				30	−	−	−	−	−	−		None.	
			a. m.												
1	12	Atchison, Topeka & Santa Fe	12.26		May 30	130	−	−	−	−	−	−		None.	
2	32	Rock Island	12.55		...do	150	−	−	−	−	−	−		None.	
3	403	Missouri Pacific	7.30		...do	400	−	−	−	−	−	−		None.	*B. pyocyaneous* present. Iced at Yates Center.
4	433	.....do	7.50		...do	300	−	−	−	−	−	−		None.	*B. pyocyaneous* present. Iced and H. O. at Wichita.
5	703	.....do	7.45		...do	450	−	−	−	−	−	−		None.	Do.
6	117	Atchison, Topeka & Santa Fe	8.20		...do	1,200	+	+	+	+	+	+	+	10	
7	309	Frisco	8.25		...do	300	−	−	−	−	−	−		None.	Car 309. Iced at Minette and Walire.
8	309	.....do	8.25		...do	150	−	−	−	−	−	−		None.	Car 1016.
9	517	Atchison, Topeka & Santa Fe	8.30	D.	May 29	550	+	+	+	+	+	+	+	10	Car 137. Iced and H. O. at Wichita.
10	1	Orient	8.35	D.	...do	500	+	+	+	+	+	+	+	6	Iced and H. O. at Wichita.
11	12	Rock Island	9.50		...do	650	+	+	+	+	−	+	+	8	Iced at Caldwell. H. O. at Chickasha, Okla.
12	506	Atchison, Topeka & Santa Fe	10.45		...do	500	+	+	+	+	+	+	+	10	Iced at Pratt; also H. O.
13	406	.....do	11.10		...do	600	+	+	−	−	−	+	+	4	Iced at Arkansas City; H. O. at Purcell.
			p. m.												
14	8	Frisco	11.15		...do	600	−	−	−	−	−	−	−	None.	Car 62.
			p. m.												
15	8	.....do	11.15		...do	550	−	−	−	−	−	−		None.	Car 1030.
16	16	Atchison, Topeka & Santa Fe (Englewood Branch).	1.50		...do	100	−	−	−	−	−	−		None.	
17	518	Atchison, Topeka & Santa Fe	1.30	A.	...do	1,200	+	+	+	+	−	+		8	Pyocyaneous present.
18	505	.....do	5.25	A.	May 30	350	−	−	−	−	−	−		None.	*B. pyocyaneous* present.

Sample No.	Train No.	Name of railroad.	Time.	Train arriving or departing.	Date, 1912.	Bacteria per cubic centimeter on agar at 37° C., 24 hours.	Gas in lactose bile. Fermentation tube No. (1 cubic centimeter)— 1	2	3	4	5	6	10 cubic centimeters confirmatory test.	Approximate number *B. coli* per 10 cubic centimeters.	Remarks.
			p. m.												
19	710	Missouri Pacific	6.20		May 30	300	−	−	−	−	−	−	−	None.	H. O. Nevada; iced at Coffeyville.
20	405	do	6.25	A.	do	350	−	−	−	−	−	−		None.	
21	2	Orient	7.00	A.	do	450	−	−	−	−	−	−		None.	Tap at depot.
22	24	Rock Island	9.20		do	500	+	+	+	+	+	+	+	10	*B. pyocyaneous* also present.
			a. m.												
23		Tap (city)	8.00			60	−	−	−	−	−	−		None.	Tap at depot Atchison, Topeka & Santa Fe.
24	2	Midland Valley	8.00	D.		400	−	−	−	−	−	−		6	Iced and H. O. at Wichita. Wichita to Fort Smith.
25		Tap				90	−	−	−	−	−	−		None.	Tap at Missouri Pacific.
26		do				80	−	−	−	−	−	−		None.	Tap at Rock Island.
27		do				60	−	−	−	−	−	−		None.	Tap at Frisco.

Altogether there were 78 samples taken from trains, and in order to simplify matters these have been rearranged into four groups, according to the degree of pollution, beginning with the worst samples in Group I and ending with the purest water in Group IV.

Group I includes 5 samples, all of these samples having at least 10 colon organisms in 10 cubic centimeters of water, or 1 per cubic centimeter of water examined, and is as follows:

GROUP I.

City.	Sample No.	Train No.	Name of railroad.	Time.	Arriving or departing.	Date.	Count per cubic centimeter on agar at 37° C., 24 hours.	Approximate number *B. coli* in 10 cubic centimeters.
				a. m.				
Kansas City, Mo	39	110	Union Pacific	9.15	A.	May 24	1,800	10
Wichita	6	117	Atchison, Topeka & Santa Fe.	8.20	D.	May 29	1,200	10
Do	9	517	Atchison, Topeka & Santa Fe (Englewood Branch).	8.30	D.	...do	550	10
Do	12	506	Atchison, Topeka & Santa Fe.	10.45		...do	500	10
				p. m.				
Do	22	24	Rock Island	9.20		May 30	500	10

Group II includes 8 samples, these having from 6 to 8 *B. coli* in 10 cubic centimeters of water.

GROUP II.

City.	Sample No.	Train No.	Name of railroad.	Time.	Arriving or departing.	Date.	Count per cubic centimeter on agar at 37° C., 24 hours.	Approximate number *B. coli* in 10 cubic centimeters.
				p. m.				
Kansas City, Mo	1	1	Rock Island	11.15	D.	May 23	800	6
				a. m.				
Do		111	Missouri Pacific	8.15	D.	May 24	1,000	8
Do	3	3	Atchison, Topeka & Santa Fe.	9.10	D.	...do	1,200	6
Do		102	Missouri Pacific	9.20	A.	...do	950	6
Wichita		1	Orient	8.35	D.	May 29	500	6
Do		12	Rock Island	9.50		...do	650	8
				p. m.				
Do		518	Atchison, Topeka & Santa Fe (Englewood Branch).	1.30	A.	...do	1,200	8
				a. m.				
Do		2	Midland Valley	8.00	D.	May 30	400	6

Group III: There are 14 samples having from 1 to 4 *B. coli* per 10 cubic centimeters of the water. In 2 of them *Streptococcus pyogenes* as well as *B. coli* was present.

Group IV: There are 49 samples in which no *B. coli* were present in 10 cubic centimeters of the water.

In Group I there are 5 samples, or 6.4 per cent, containing 10 colon bacteria in 10 cubic centimeters of the water, or 1 per cubic centimeter with bacterial counts ranging from 500 to 1,800 per cubic centimeter. In 1 sample *B. pyocyaneous*, the green pus organisms were found to be present. Waters in this group are decidedly unfit for drinking purposes.

In Group II there are 9 samples, or 11.4 per cent, in which there are 6 to 8 colon organisms in each 10 cubic centimeters of the water, with the bacterial count ranging between 400 and 1,200 per cubic centimeter. These waters are open to strong suspicion and should not be drunk.

In Group III there are 14 samples, or 17.8 per cent, having from 1 to 4 *B. coli* in each 10 cubic centimeters of the water, with comparatively high counts.

Of the 49 samples in which no *B. coli* was found, 22 of them, or 44.9 per cent, show counts developing at body temperature of over 350 bacteria per cubic centimeter, and 18 of these have 500 or more bacteria per cubic centimeter. Thirty-one samples show counts under 500 per cubic centimeter, and of these 27, or about one-third of the total number of samples examined, are under 350 per cubic centimeter. That is, if we attribute any significance—and we must—to the number of bacteria developing at the body temperature, and adopt even 350 per cubic centimeter as a dividing line between clean and dirty water, we find that of the 78 samples examined only 27, or about one-third, showed themselves to be sufficiently clean for drinking purposes.

The possible sources of pollution in these samples of water may be grouped as follows:

1. From the original water supply.
2. From the water used in the ice.
3. From the dirt adhering to the ice.
4. From the hands or person of the individual handling the ice.
5. From the buckets, wheelbarrows, or tongs used in carrying and handling the ice.
6. From carelessness in washing the tanks as to thoroughness and as to kind of water used in washing.

The following data as to the water and ice furnished passenger trains in Kansas was supplied by the railroads to Dr. Crumbine:

Name of railroad.	Station.	Water or ice.	Source.	Method of handling.
Rock Island	Armourdale	Water	Railroad plant	Buckets and tongs.
	Do	Ice	Manufacturing plant	Do.
	Horton	Water	Well	
	Do	Ice		Tongs.
	Topeka	Water	City	
	Do	Ice	Manufactured	Buckets.
	McFarland	Water	Well	
	Do	Ice	Manufactured	Do.
	Herington	Water	Railroad plant	
	Do	Ice	Manufactured	Tongs.
	Caldwell	Water	City	
	Do	Ice	Manufactured	Buckets.
	Liberal	Water	Railroad plant	
	Do	Ice	Manufactured	Do.
	Pratt	Water	Railroad plant	
	Do	Ice	Manufactured	Do.
	Belleville	Water	City	
	Do	Ice	....do	Do.
	Goodland	Water	Railroad plant	
	Do	Ice	Manufactured	Do.
	Phillipsburg	Water	Railroad plant, piped from Glade.	
Missouri, Kansas & Texas.	Parsons	Water	City	
	Do	Ice	Manufactured	
	Kansas City	Water	City	
	Junction City	...do	....do	
	Do	Ice	Manufactured	
	Iola	Water	City	
	Do	Ice	Manufactured	

Name of railroad.	Station.	Water or ice.	Source.	Method of handling.
Union Pacific Ry	Armstrong	Water	City	
	Do	Ice	Natural and manufactured.	
	Manhattan	Water	Railroad plant	
	Do	Ice	Natural and manufactured.	
	Junction City	Water	City	
	Do	Ice	Natural and artificial	
	Solomon	Water	Railroad plant	
	Do	Ice	Natural and manufactured.	
	Salina	Water	Railroad plant	
	Do	Ice	Natural and manufactured.	
	Ellis	Water	Railroad plant	
	Do	Ice	Natural and manufactured.	
	Leavenworth	Water	City	
	Do	Ice	Natural and manufactured.	
	Onaga	Water	Railroad plant	
	Do	Ice	Natural and manufactured.	
	Miltonvale	Water	Railroad plant	
	Do	Ice	Natural and artificial	
	Belleville	Water	Railroad plant	
	Do	Ice	Manufactured	
	Beloit	Water	Railroad plant	
	Do	Ice	Manufactured	
	Plainville	Water	Railroad plant	
	Do	Ice	Natural and artificial	
Orient Ry	Wichita	Water	Railroad plant	
	Do	Ice	Manufactured	
Chicago, Burlington & Quincy.	Concordia	Water	Railroad plant	
	Do	Ice	Natural	Buckets.
	Atchison	Water	City	
	Do	Ice	Natural	
	Oberlin	Water	Railroad plant	
	Do	Ice		Put in tanks by roundhouse men.
	St. Francis	Water	Railroad plant	
	Do	Ice		Do.
St. Louis & San Francisco.	Ellsworth	Water	Railroad plant	
	Do	Ice	Manufactured	
	Wichita	Water	City	
	Do	Ice	Manufactured	Tongs and buckets.
	Beaumont Junction	Water	Enid and well	
	Do	Ice	Manufactured	Hooks and buckets
	Cherryvale	Water	City	
	Do	Ice	Manufactured	
	Fort Scott	Water	City	
	Do	Ice	Manufactured	Tongs.
Missouri Pacific	Nevada, Mo	Water	City	
	Do	Ice	Manufactured	
	Joplin, Mo	Water	City	
	Do	Ice	Manufactured	
	Butler, Mo	Water	City	
	Do	Ice	Manufactured	
	Madison	Water	City	
	Do	Ice	River	
	Kansas City (Cypress)	Water	City	
	Do	Ice	Natural	Trucks and tongs.
	Osawatomie	Water	City	
	Do	Ice	Natural	Tongs.
	Council Grove	Water	City	
	Do	Ice	Natural	Do.
	Topeka	Water	City	
	Do	Ice	Artificial	Do.
	Salina	Water	City	
	Do	Ice	Artificial	Do.
	Marquette	Water	City	
	Do	Ice	Artificial	Do.
	Hoisington	Water	Railroad plant	
	Do	Ice	Artificial	Do.
	Leavenworth	Water	City	
	Do	Ice	Artificial	Do.
	Seneca	Water	City	
	Do	Ice	Artificial	Do.
	Atchison	Water	City	
	Do	Ice	Artificial	Do.
	Greenleaf	Water	City	
	Do	Ice	Artificial	Do.
	Concordia	Water	City	
	Do	Ice	Artificial	Do.

Name of railroad.	Station.	Water or ice.	Source.	Method of handling.
Missouri Pacific	Prosser, Nebr	Water	Railway company's well.	
	Downs	do	do	Tongs.
	Do	Ice	Natural	Do.
	Stockton	Water	City	
	Fort Scott	do	do	
	Do	Ice	Artificial	Do.
	Yates Center	Water	Well	
	Do	Ice	Artificial	Do.
	Eldorado	Water	City	
	Do	Ice	Artificial	Do.
	Wichita	Water	City	
	Do	Ice	Artificial	Do.
	McPherson	Water	City	
	Do	Ice	Artificial	Do.
	Kanopolis	Water	Well	
	Hardtner	do	do	
	Coffeyville	do	City	
	Do	Ice	Artificial	
	Conway Springs	Water	City	
	Do	Ice	Artificial	Do.
	Arkansas City	Water	City	
	Do	Ice	Artificial	Do.
	Roper	Water	Well	
	Do	Ice	Artificial	Do.
Atchison, Topeka & Santa Fe.	Argentine	Water	Company's well	
	Do	Ice	Artificial	
	Emporia	Water	City	
	Do	Ice	Artificial	
	Atchison	Water	City	
	Do	Ice	Artificial	
	Leavenworth	Water	City	
	Do	Ice	Artificial	
	Ottawa	Water	City	
	Do	Ice	Artificial	
	Chanute	Water	Company's well	
	Do	Ice	Artificial	
	Cherryvale	Water	Melted ice	
	Do	Ice	Artificial	
	Moline	Water	Company supply	
	Do	Ice	Artificial	
	Coffeyville	Water	City	
	Do	Ice	Artificial	
	Independence	Water	City	
	Do	Ice	Artificial	
	Colony	Water	Cistern	
	Do	Ice	Artificial	
	Cedarvale	Water	Cistern	
	Do	Ice	Artificial	
	Strong City	Water	City	
	Do	Ice	Artificial	
	Wichita	Water	City	
	Do	Ice	Artificial	
	Ellinwood	Water	City	
	Do	Ice	Artificial	
	Barnard	Water	City	
	Do	Ice	Artificial	
	Salina	Water	City	
	Do	Ice	Artificial	
	Arkansas City	Water	City	
	Do	Ice	Artificial	

All the sources of the water supplies investigated showed them to be good, potable water; inspections of the ice used in coolers quite often revealed the presence of dirt in artificial as well as in natural ice. Bacteriologists tell us that we must not lay too much stress on a body temperature count alone. Yet, from the data obtained at Kansas City, it will be noted that of those trains watered at Kansas City nearly 20 per cent had counts under 100 per cubic centimeter and 12 per cent had counts of 40 per cubic centimeter or less, while the source of supplies showed a count of 20 per cubic centimeter, with no B. coli present.

From this data, and after making a sanitary survey of conditions, it seems that there is no excuse for so many samples having a body temperature count of over 350 per cubic centimeter, and the conclusions we believe to be fairly drawn are that these high counts show carelessness both in cleaning the coolers and in handling the ice.

Evidently the abolishment of the common drinking cup in railroad trains will not of itself insure a wholesome water supply, but very definite regulations concerning the proper cleansing and sterilization of all coolers and a sanitary method of handling the ice or, better still, cooling the water through coils covered with ice, must be insisted upon before the health of the traveling public is efficiently and uniformly safeguarded from infectious water-borne diseases.

[1] Jour. Infec. Dis., March, 1906.

[2] Technology Quarterly, VI, 241.

[3] A study of the numbers of bacteria developing at different temperatures and of the ratio between such numbers with reference to their significance in the interpretation of water analysis. Biological studies by the pupils of William Thompson Sedgwick, Boston, 1906.

DISCUSSION.

Dr. A. J. McCannel, North Dakota: About a year ago I made some study of the subject of the drinking water provided for the general public on railway trains. I corresponded with the division superintendents of several large railway systems, asking them about the source and method of handling of the drinking-water supply for their trains. In a large percentage of cases no bacterial or chemical examinations of the water had ever been made. In most cases no regular examinations were made. Most of the water supplied was presumed to come from pure sources, but there were a few wells reported as deserving of suspicion.

Concerning the care of water coolers, nearly all were reported to be washed out at longer or shorter intervals. This washing, in most instances, is just a rinsing with cold water and a whisk broom, or something of the kind. About half are scalded or otherwise disinfected at intervals of from two days to a month. Some are "scalded when needed," and about 50 per cent not at all.

The railways of the South use artificial ice, while those of the North use the natural product. We are all familiar with the handling of ice for railway trains. It is cut up on the platform, and then stored in buckets to await the coming of the train, and it is lucky indeed if it reaches the water cooler without picking up from the hands through which it passes, the surrounding air, and the ever-present dog much that is not good to drink.

In examining samples of water from the coolers in some cases I found colon bacilli present where the total bacterial count was very

small. The fact that most of the water in the cooler comes from melting ice would account for the low bacterial count, and this would indicate also that the colon bacilli present had come from the handling of the ice on its way to the cooler.

The remedy for this contamination of water is to have the coolers so arranged that the ice is not placed in the water, but is used only for cooling purposes. This is, I believe, done in all railway post-office cars by order of the Federal Government, and it should be done in all cars, for the protection of the general public.

Dr. J. W. KERR, United States Public Health Service: In the United States, in the recent past, much attention has been directed to governmental regulation of railroads. Laws have been passed to this end and their enforcement has become one of the great activities of the Government. One might suppose, therefore, that further regulation would be discouraged by the great railway corporations, yet a representative of one of them has to-day advocated additional supervision in the interest of safety of passengers and employees. The service to which I belong has for years made visual examinations of masters and pilots, as required by navigation laws. It can not be doubted that such examinations are highly beneficial, and it would seem to me that careful physical and mental examinations of railway employees having to do with the handling of trains in interstate traffic would be even more beneficial and should be required.

Many people are prone to overlook the improvements that have gone on in railway sanitation. In my opinion, the railway officials have kept abreast of the general public in this matter, and, in some directions, they have been ahead of it.

As we have just heard, the Baltimore & Ohio Railroad and others have for years provided rest stations and organized relief for their employees. In response to suggestions and demands, the Pullman Co. has made many sanitary improvements. I believe corporations will, for business and other reasons, cooperate with health authorities in putting practical measures into practice.

As people become better educated in sanitary matters they will demand improved conditions and get them, but the necessity for improved conditions must be recognized, and it is one of the immediate duties of the health authorities to teach the people.

As stated yesterday by Judge Clements, there can be no doubt that Congress has power, under the Constitution, to legislate for the improvement of insanitary conditions, when the necessity of such legislation shall have been impressed upon it. The collection of facts is now the first duty of Federal and State authorities, and there is provision in the law of July 1, 1902, whereby they can meet in conference on railway sanitation, and devise means for its improvement.

THURSDAY AFTERNOON, SEPTEMBER 26, 1912.

THE DISPOSAL OF SEWAGE INTO TIDAL WATERS.

GEORGE A. SOPER, Ph. D., President, Metropolitan Sewerage Commission of New York.

The sanitary protection of tidal harbors against sewage is one of the most recent subjects to engage the attention of sanitary engineers. The fact that the tide produces oscillating currents often makes it impossible to discharge sewage into the water with the certainty that it will be carried promptly away from the place where it originates, as is the case with inland rivers. The saltiness of the water adds difficulty to the problem, inasmuch as it tends to make the sewage which is discharged beneath the surface of the water rise to the top, on account of its higher specific gravity.

Engineers have not yet given the subject of sewage disposal into tidal waters the thorough study which will be necessary before the many physical, chemical, and biological questions concerned are fully understood. Because of the existence of the peculiar problems relating to health and the production of nuisance which are connected with the disposal of sewage into salt water, the knowledge which has been obtained in studying the effects of discharging sewage into land water can not strictly be applied. Until a considerable mass of information has been collected by painstaking individual studies, each problem of sewage disposal for a seaport must be studied strictly upon its own merits.

The number of seaport cities which have been compelled, after more or less study, to construct extensive works to prevent the overpollution of their navigable waters is large and constantly growing. Included in the list are London, Paris, Hamburg, Bremen, Amsterdam, Marseille, Glasgow, Belfast, and Dublin, in Europe, and Boston, Providence, Baltimore, and Washington, in America. Some of these cities purify their sewage to a considerable extent, and others carry it a long distance toward the sea before emptying it into the tidal waters. In most cases the works have been rendered necessary in order to prevent a nuisance. In some instances they have been built to remove a nuisance which has already become intolerable.

The city of New York affords the most recent example of a great seaport which has been compelled to solve the problem of disposing

of its sewage, and in doing so it has brought careful investigation to its aid. The capacious harbor, although possessing two main outlets to the sea, has become overburdened with the sewage of the population residing upon its shores. By the year 1940 the population draining into the harbor, which is now about 6,000,000, will be nearly doubled, and it is estimated that the quantity of sewage will be 1,800,000,000 gallons per 24 hours. When it is remembered that the water which will be available for the assimilation of these wastes will be no more than it is at the present time, it becomes obvious that such objectionable conditions as now exist will be greatly aggravated if the sewage problem is not solved.

In devising an improved system of sewage disposal for New York, it will be necessary to make full use of the digestive capacity of the harbor water for sewage, because of the large sums of money which it would be necessary to spend in order to dispose of the sewage on farm lands, by intensive purification or by pumping to the open ocean. It appears that the water can be used to a considerable extent in this way without involving danger of nuisance or disease.

As an aid toward the planning of such works as may be necessary in order to purify the sewage before discharging it into the water, a standard of cleanness or limit of pollution for the water has been established. This standard takes careful account of the appearance of the water as well as of its oxygen and bacterial content. Since it defines the permissible limits of pollution for New York Harbor, and at the same time describes conditions which may or may not be tolerable in other harbors, depending upon the uses to which their waters are put, it will be given here. The standard follows:

1. Garbage, offal, or solid matter recognizable as of sewage origin shall not be visible in any of the harbor waters.

2. Marked discoloration or turbidity, due to sewage or trade wastes, effervescence, oily sleek, odor, or deposits shall not occur except perhaps in the immediate vicinity of sewer outfalls, and then only to such an extent and in such places as may be permitted by the authority having jurisdiction over the sanitary condition of the harbor.

3. The discharge of sewage shall not materially contribute to the formation of deposits injurious to navigation.

4. Except in the immediate vicinity of docks and piers and sewer outfalls the dissolved oxygen in the water shall not fall below 3 cubic centimeters per liter of water.[1] Near docks and piers there should always be sufficient oxygen in the water to prevent nuisance from odor.

5. The quality of the water at points suitable for bathing and oyster culture should conform substantially as to bacterial purity to a drinking water standard. It is not practicable to maintain so high a standard in any part of the harbor north of the Narrows or in the Arthur Kill. In the lower bay and elsewhere bathing and the taking of shellfish can not be considered free from danger of disease within a mile of a sewer outfall.

A careful reading of the provisions of this standard shows that a great deal of importance is placed upon the need of keeping the water clean. The harbor is, in fact, a highway, and its sanitary condition is considered to have an important bearing upon the health and convenience of the public. It is intended that the specifications shall be interpreted intelligently and with considerable reference to the modifying effects which local conditions may impose.

The measures which should be followed in disposing of the sewage, and maintaining the standard here given, are being devised by an official body known as the Metropolitan Sewerage Commission. This commission is a temporary body which was especially created to do the work which it is doing, and consists of four engineers and one physician.

The work of the commission may be said to be of two parts—investigations and planning.

The investigations have extended over a territory of about 700 square miles of land and water. Not only New York but also the numerous cities and villages immediately tributary to the harbor were taken into consideration. The sewerage systems were studied, as were the populations, in order to determine the conditions and extent of the present and probable future pollution. Floating laboratories were established, which moved from point to point collecting and analyzing the water and deposits from the harbor bottom. Tidal studies were made in cooperation with the United States Coast and Geodetic Survey in order to determine the direction and velocities of the currents and the quantities of water flowing past various points in the harbor at all stages of tide and at all seasons of year. Experiments intended to throw light upon the circumstances under which the sewage could be made to diffuse and become assimilated in the harbor water were undertaken, first, with laboratory apparatus, and, later, with tank steamers loaded with sewage which, under carefully prearranged conditions, was pumped overboard at selected points.

As might be expected, the water of the harbor has been found to be heavily polluted, as gauged by such standards as those which are commonly applied to drinking water. Consequently bathing is dangerous and shellfish are unsuitable for food unless gathered from points most remote from the sewage outlets. The gathering of driftwood, the handling of fishlines, ropes, and other objects wet with sewage, is attended by risk of diseases, especially in the neighborhood of the docks and piers where most of the sewers discharge.

The investigations of the commission have shown that the sewage which New York and its neighboring cities discharge into the harbor is not properly flushed out to sea by the tides, and the discharge of the rivers which flow through the harbor is comparatively small. The

rise and fall of the tidal level, which occurs to the extent of about 4½ feet, cause the water and its load of sewage to flow back and forth indefinitely near its point of origin.

The chief instrument in the disappearance of the sewage is the capacity which the water itself possesses for assimilating the impurities. This capacity lies mainly in diffusing, liquefying, and oxidizing processes. The final change is one of oxidation, in which living organisms, chiefly the bacteria, play a prominent part. In many respects the natural purification of sewage by water resembles the natural purification of sewage by land.

Probably the best index of the burden which the sewage puts upon the assimilative capacity of the harbor lies in the amount of dissolved oxygen in the water. Whereas the normal amount of oxygen which is present in unpolluted rivers and salt-water bays is 100 per cent, the oxygen in New York Harbor ranges between 50 and 60 per cent.

Some idea of the burden of pollution may also be obtained by comparing the volume of crude sewage with the volume of the water. The ratio of the direct daily discharge of sewage to the net seaward flow of water in the lower East River, which is one of the most important sections, is 1 to 5.9. Elsewhere the proportion is not always so large, but there are parts of the harbor where it is greater.

Plans for collecting all of the sewage for final disposition to one central point have been made, and preliminary estimates of cost prepared, but this is not the solution of the problem which the commission considers best, and the cost, over $150,000,000, seems unnecessarily great.

It has been considered better to separate the city of New York, for purposes of sewage disposal, into four main drainage divisions, and to work out in each division the systems of arterial sewerage and sewage disposal which are necessary and sufficient for the water in its vicinity and in the harbor as a whole. This work is nearing completion.

A prominent feature of the work of the Metropolitan Sewerage Commission has been a study of the part played by oxygen in the assimilation of the sewage by the tidal waters. The studies in this direction described by the Royal Commission on Sewage Disposal, of Great Britain, in its fifth report have been extended, the New York commission's researches being facilitated by modifications made in the method of determining the amount of dissolved oxygen in the water, which have permitted thousands of analyses to be made, sometimes in open boats and in rough weather.

At the conclusion of the commission's work there will have been devised comprehensive engineering projects of main drainage for the protection of the harbor, and a definite recommendation as to the jurisdiction under which this system of conservancy should be con-

structed and maintained. The total cost of the studies, including the publication of reports, will be about $200,000.

The reports thus far issued by the commission consist of two bound volumes of quarto size, and of various printed pamphlets which have been issued as interim reports.

[1] With 60 per cent of sea water and 40 per cent of land water and at the extreme summer temperature of 80° F., 3 cubic centimeters of oxygen per liter of water corresponds to 58 per cent of saturation.

THE ADVANCE IN QUARANTINE INCIDENT TO THE OPENING OF THE PANAMA CANAL.

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The Panama Canal, justly termed the crowning engineering feat of history and of prospect, is soon to be opened for the world's business. Then will many artists and artisans display the result of their genius and handiwork, and perhaps there will never again be such a combination of demand and opportunity for the ingenuity of specialists in so many different lines; and, after the completion of this waterway, there will arise new opportunities for the exercise of executive ability in many directions, and also unparalleled opportunities for laborers in all fields of work to win honor and advancement for themselves by their display of common sense and loyalty in connection with the maintenance and conduct of this wonderful and useful piece of mechanism. The glory in sight, the connecting, the hyphenating of two great oceans, will be followed by world-affecting results. Many ports and places hitherto widely separated will be brought into close commercial and social intercourse. Certain towns which to-day are obscure way stations on the international trade routes will grow into important cities. Other cities may shrink from metropolitan communities into obscure towns.

This 41 miles of waterway, costing $375,000,000 to build, and traversible by 58 vessels daily, will greatly strengthen the military power of the United States and greatly increase the efficiency of the American Navy. It will enable the peoples and freight of the world to pass to and fro and cause a rearrangement of the ocean highways, and who knows but that it may not finally bind the nations together, for such an unparalleled convenience for the purposes of war as well as of commerce must surely be a powerful and conclusive instrument for preserving peace.

But the opening of the canal will carry with it, in addition to its many glories, many responsibilities, not the least of which will be many public health and quarantine problems. It is for the purpose

of inviting your views and comments on these problems that I present this paper here.

The conditions upon which these problems are based must be first considered. These conditions are the immediate and future trade connections which it is predicted will follow the opening of the great waterway. The trade connections may for convenience of description be divided, therefore, into the two headings suggested, immediate and future. It is confidently expected that the immediate trade exchanges will affect the following territory:

The east and west coasts of North and South America, exception being made of a small part of the trade of southern Chile, and also of the Caribbean coast of South America and the west coast of Central America (the reasons for the last exceptions being that both these sections of the world export much the same articles, and their imports consist of manufactures from Europe and the United States).

The North American ports will export food products, iron and steel manufactured supplies, and general merchandise. The Central American and South American ports will return, through the canal, wool, nitrate of soda, sugar, and ores. It is thought that while Chile will buy from all parts of the world, her trade with the South will show a marked increase, for the reason that the South will buy nitrate of soda from Chile and, with its stores of phosphate rock, export a manufactured fertilizer to all the countries bordering on the Pacific Ocean. This trade will probably necessitate a double trip through the canal.

Now, a word as to the possibilities of disease interchange through the canal between the east and west coasts of North and South America. Both Ecuador and Chile, judging from their past sanitary history, are liable to export the infection of plague and yellow fever. Peru is liable to export plague and possibly yellow fever, although this latter disease has not been reported present in Peru since the latter part of 1910. On the Atlantic side, yellow fever may be expected from the Mexican, Colombian, and Venezuelan ports, and, from their past sanitary history, the ports of Costa Rica, Honduras, Guatemala, and Nicaragua are capable of becoming at any time infected with this disease. Plague, you will recall, has recently appeared in Trinidad and Cuba and also in United States territory, Porto Rico and Hawaii. In addition to this, and as you may perhaps be aware, plague is still present amongst the ground squirrels of certain portions of northern and middle California, so that between the east and west coasts of North and South America two sets of yellow fever and plague zones will be brought into intimate association. The east and west coasts of North and South America, now far removed from each other on account of the geographical barriers which the Isthmus of Panama forms between the

Atlantic and Pacific Oceans, will then be directly connected, and transmissible diseases, no longer impeded in their course by transcontinental railways, are liable to be brought direct in vessels through the new marine route, the Panama Canal.

The next set of trade exchanges predicted are between the east coasts of North America and Pacific Asia and Australia, including the Pacific islands. It is estimated that this commerce, expressed in ship's tonnage, will be 10,500,000 for the year 1915.

The North American ports will export general merchandise and food products from the territory of the North Atlantic; manufactured fertilizer, raw cotton, and flour from the South Atlantic; and cotton, cotton goods, lumber, and manufactured iron and steel from the Gulf ports, and, in exchange, will import raw silk, straw mattings, rugs, tea, notions, rattan, cane bamboo, and coal from Japan; raw and manufactured silk, tea, rice, hemp, peas and beans, hides, bristles, wool, wax, and curios from China; sugar from Hawaii; hemp, copra, sugar, and tobacco from the Philippine Islands; and wool, coal, food supplies, and raw materials from Australasia.

The character of this freight is mentioned for the reason that, through the peculiar way in which it must be packed for shipment, it affords easy nesting places for rats; it now being an accepted fact that there is no one factor more important in connection with the transmission of plague than the frequency with which rats are transferred from vessels to shore, and vice versa, in loosely packed or crated freight, or else in food supplies of various kinds which are shipped in gunny sacks.

It must be admitted from the above that the plague and cholera of the Orient, through the medium of plague-infected rats and human cholera carriers, will be easily possible of transmission by direct shipment in vessels; and, by these same vessels carrying their return cargoes, it will be possible for infected stegomyiæ to carry yellow fever to the Orient, where this mosquito now abounds.

In this connection a prediction regarding the large part which tramp steamers will play in the world's commerce is not amiss. It is thought that the Australian and Japanese coal and, if the mines of China are ever developed, the Chinese coal, will be carried to all ports bordering upon the Pacific Ocean. This trade, it would seem, will be an important factor in increasing the interchange of quarantinable disease, which ultimately may affect the Canal Zone or even the ports of eastern North and South America.

I have described the important trade exchanges incident to the opening of the Panama Canal. I will now mention the future trade exchanges.

The first future trade exchange predicted will be an increase in the Chinese trade after the political conditions in that country have

assumed a stable basis and its vast resources have been exploited. The same may be said of Japan, it being asserted that that country will be visited by an industrial revolution which will cause her to require more and more the products of the United States.

The second future trade exchange will likely be the use of the canal for through shipping between Europe and Australia, it being predicted that 10 per cent of this trade will use the canal immediately upon its completion, as will also the fully loaded outbound vessels from Japan to Europe.

Now, let us consider the sanitary dangers suggested by the maze of ocean routes and connections which have just been mentioned:

1. All the conditions are present for the spread of yellow fever in Asia.
2. Plague is now present in Asia.
3. Yellow fever is now present in some of the Mexican, Gulf, and Caribbean coast ports.
4. Plague and yellow fever are now present on the west coast of South America.
5. Rats are present everywhere, the Canal Zone not excepted.
6. Stegomyiæ are present in a belt surrounding the earth between 38° north and 38° south latitude.

In discussing this broad subject let us liken the Atlantic and the Pacific Oceans, with their surrounding ports, to two vast arenas which we, for our convenience, will term the sanitary arenas of the Atlantic and the Pacific. We all of us know that quarantine operations are being carried on to-day in these arenas under special and varying policies according to the geographical distribution of the quarantinable diseases and also according to the many influences which tend to modify, enhance, or prevent the spread of these diseases. These general conditions cause quarantine to be administered in a local sense as between individual ports, and the burden of protection is placed upon the individual quarantine station, subject to such modifications as can be permitted in acknowledgement of the good sanitary condition of the port of departure of a vessel or any special public-health measures which are carried out by the individual vessel.

After the opening of the canal, when the Atlantic and the Pacific arenas are connected, the wonderful and complex commercial hourglass thus formed will immediately give rise to an entirely new set of quarantine problems, which latter will revolve around the absolute necessity of keeping the aperture of the hourglass, the Canal Zone, in a sanitary condition.

This must of necessity depend upon the correlation of two sets of expedients: First, structural arrangements throughout the Canal Zone, based upon sanitary science, together with an efficient local sanitary organization. Second, the maintenance of quarantine stations at the terminals of the canal.

The first requisite will undoubtedly be made the object of special endeavor by the makers of the canal who, in a manner commensurate with the excellence of their achievements along other lines, may be depended upon to furnish the world a model of municipal sanitary preparedness and organization. Assuming that quarantine stations at the terminals of the canal will be necessary as the first line of defense in disease protection for the Zone, the first question presenting itself is to what extent must the task of protecting the Canal Zone from disease be thrown upon these quarantine stations? In other words, both municipal or internal sanitation and quarantine being necessary for the canal, in what proportion shall these two functions be applied to the best advantage? If the quarantine is made too rigid it will react as a form of excessive toll against the use of the canal. On the other hand, if, by undue liberality in quarantine administration, the Canal Zone becomes infected, many vessels will elect to take other routes rather than run the risk of quarantine detention with the consequent expense at their distal ports of arrival.

It may be found, after the canal is put into operation, that the ingenuity put forth and money expended to this end have produced a zone impregnable to infection from the quarantinable diseases. This is only a possibility, but, granting that such will be the case, there will still remain the need for quarantine stations at the terminals of the canal to prevent disease interchange between the ports bordering upon the two great oceans. One of the most important reasons for the construction of the Panama Canal is to shorten ocean routes, and tolls will be paid by ocean carriers to reduce the time and expense of performing specific transportation services, and the degree to which the tolls approximate the saving effected by the canal will determine how much any other influence, such as the quarantine hazard, will affect the total cost of using the canal, or, in other words, will increase the total amount of tolls.

Therefore, distance and time of voyage between ports of departure and destination will not be the only factors in determining the selection of routes. Lower insurance rates may influence carriers to select the route that exposes the ship or cargo to the least risk, and under the heading of risks will come the question of possible or probable infection with the quarantinable diseases.

The two terminal quarantine stations at the canal, the reasons for the existence of which will probably be admitted by everyone, are destined to be unique institutions of their kind, and to be conducted as models of perfected quarantine organization and equipment. Nor will their field of usefulness be limited to the functions of removing quarantinable diseases from vessels, and the subsequent treatment of the latter. It may be confidently expected that the natural although

temporary accumulation of the various quarantinable and communicable diseases at these stations will afford surpassing facilities for the instruction of cadet quarantine officers and others interested in work of this kind. That there will be a demand for carefully trained quarantine officers for advance quarantine work, it is the purpose of this paper to demonstrate.

The term "advance quarantine" is new, but it may be accepted at its face value, for it is self-explanatory. Advance quarantine, or quarantine in advance, in general comprises any public-health measures carried out at the ports of departure for the protection of vessels, either while in port or on the voyage, which measures may serve to modify or to obviate treatment at the various quarantine stations called at by the vessel. This policy is not new; on the contrary, it has been practiced and steadily developed for a number of years by the United States Public Health Service. The possibilities of advance quarantine as applied to the Panama Canal may be imagined from the difference in quarantine treatment which could be safely accorded two vessels from, let us say, a plague-infected port, one of the vessels having been rendered structurally rat proof, or as nearly so as possible, and the other vessel having received no attention along these lines; the crew and passengers of one vessel protected from smallpox by vaccination, the other not; in one case the vessel having been screened against mosquitoes and all measures against these insects carried out, and in the other vessel not; in one case the vessel's crew and passengers taken exclusively from noninfected districts, and in the other not; in one case the vessel loading from a rat-proof wharf, or from rat-clear lighters, under proper rat defense precautions, and in the other not; and so on.

The advance quarantine incident to the Panama Canal might be operated under two divisions or heads:

1. Advance quarantine for vessels.
2. Advance quarantine for ports.

In the organization and conduct of this project business men and quarantine officers would be principally interested; therefore a commission composed of steamship men and public-health officers should be appointed to formulate plans along the following lines:

1. The education, through the Public Health Service, of ship surgeons in sanitary and quarantine matters.
2. The betterment of sanitary conditions surrounding the water fronts and wharves in the various ports.

In carrying out advance quarantine for vessels it is proposed to utilize ship surgeons especially trained in maritime quarantine practice as traveling quarantine officers. A large steamship carrying perhaps between 1,500 and 2,000 persons, with an itinerary including both clean ports and ports infected with such diseases as yellow fever,

cholera, and plague, will prove in the long run a menace to some clean port and a source of danger to the general public unless some radical reforms are made in what might be termed maritime sanitation. Such a large passenger vessel should be considered as a floating town or community, and, so far as its sanitary welfare is concerned, should be appropriately equipped. For example, a large passenger vessel plying between the United States and Asiatic ports through the Panama Canal should be provided with an itinerant quarantine or health officer, who should make it his sole object to study the sanitary condition of his vessel, and to be prepared to conduct any quarantine procedure found to be necessary. It is believed that this innovation could be made to effect a great saving of time as compared with the present methods of quarantine examination, and, besides proving a source of economy to the shipping interests, would insure a high degree of sanitary safety in the handling of vessels.

The duties of the itinerant quarantine officer would include the surveillance of the sanitary system of the vessel, the food and water supply, the ventilating and heating of the living compartments, the observance of precautions against the ingress of rats and mosquitoes to vessels, a constant warfare upon rats both through "outbuilding" and ordinary processes, a constant sanitary surveillance over the habits of the officers and crew of the vessel, and in the event of the infection of the vessel the prompt and intelligent application of quarantine principles.

In carrying out advance quarantine in ports the commission, composed, as suggested above, of business men and public-health officers, would try rather to protect the shipping destined to use the canal than to institute sanitary measures in the ports themselves, these latter measures being strictly in the province of the local sanitary authorities.

That is to say, the proposed commission could, for purely business and public-health purposes, plan shipping facilities in infected ports which would remove the danger of the infection of vessels carrying cargoes from such ports, and would be independent of any public-health measures which were being carried out by the port sanitary authorities.

For example, isolated wharves removed 300 meters from mosquito-breeding places could be made safe places for handling vessels in ports infected with yellow fever.

In the same way, rat-proof wharves would insure immunity from infection to shipping in plague-infected ports. There are at present such wharves in several ports. Their commercial value is almost without limit because of the quarantine exemption resulting from their use. The maintenance of proper and adequate detention barracks for immigrants or outgoing steerage passengers should devolve

upon the business and shipping interests, as should also the erection and care of sailors' boarding houses designed for the protection of shipping as a natural result of removing sailors from the miserable conditions and influences with which they are almost universally surrounded when ashore.

It is not intended to indicate by the foregoing suggestions that municipal sanitation in the various ports in the Atlantic and the Pacific should be neglected. On the contrary, it is confidently expected that the needs for sanitary preparedness when the Panama Canal is opened will be appreciated by the proper local sanitary authorities. The municipal sanitation of ports as a factor in the solution of the Panama Canal problem is so important that it may be said that the municipalities almost hold the key to the situation. The ports in the Atlantic and the Pacific arenas must be rendered as impregnable as possible to infection by quarantinable disease if quarantine is to be operated with the least degree of hardship to commerce and communities. Sanitary reforms should be inaugurated with a view of effecting a definite standard for the ports in the arenas. These ports should be inspected regularly by accredited medical officers who are trained in quarantine usage and requirements. The hygienic condition of these ports should receive a definite sanitary rating, and this rating should be reviewed or modified from time to time as indicated by the success or failure of the municipality to maintain a proper sanitary standard.

It is conceded that the Panama Canal will serve the world for commercial, military, naval, and even universal peace purposes. Is it not also possible that the Panama Canal could be made the reason or basis for the formation and maintenance of a real international sanitary reciprocity? This zone which links the two great oceans of the world is the focal point of commerce not only for the Western Hemisphere but also for the entire globe as well. It is of vital importance to the commercial prosperity of all the peoples of the earth that this point to which all the trails of trade converge shall not be a place for the interchange and dissemination of disease. It will be impossible for any nation, no matter what its strength and sincerity of purpose may be, to prevent this by its own unaided efforts. This is a matter for all the world, and if the strong nations will unite not only to the end that their own commerce bear no disease to the Panama Canal but also for the purpose of aiding the weaker powers to the same purpose, an effect will be produced which will be of lasting good to all mankind. This can be best accomplished by the formation of an international sanitary union which shall receive the moral and financial assistance of the nations joining in it. The purpose of this organization will be to set an example in the cleanliness of the ports of its members which will be an inspiration to other

nations; to aid the weaker powers by advice and moral suasion and, should the occasion demand, to coerce those recalcitrant members of the society of nations who refuse to be a party to this movement for international health and prosperity.

If disease is prevented from existing in the marts of trade, its dissemination along the highways of commerce will cease, and when this has been accomplished there remains only the problem of eradicating the commercially communicable diseases in the interior cities, and thus we will have brought about an end result which will make for the peace and happiness of all mankind.

BETTER SANITATION FOR SHIPS' CREWS.

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The present time, when a great catastrophe has directed world-wide attention to the construction of ships as to safety and the provision of adequate means of escape in the event of disaster, seems suitable to again direct attention to the generally hitherto inadequate sanitary accommodation for crews.

Ships being the means of transport between countries, either sea-girt or with a marine frontier, raise this subject to a plane of more than national importance, and justify the fixing of an international standard.

Health legislation in most countries aims at improving the sanitary environment of the people and prescribes requirements for the dwelling and the workshop. In most health acts there is a provision for the condemnation of houses "unfit for human habitation." However low the standard may be which brings dwellings under this category, it is safe to say that in modern cities the conditions of even slum cellar dwellings, where such are still tolerated, and tenement property, seldom as to cubic space, and not often as to being dirty, damp, and ill ventilated, fall below the gruesome condition of the foul-smelling forecastle, all too frequently found, where seamen are condemned to herd.

The practice in shipbuilding has been to make the provision of space for the accommodation of the crew a mere afterthought in planning, a question for consideration after general construction, after all other requirements for passengers, cargo, engines, and navigation have been met.

Nearly two years' experience at Port Said as a boarding medical officer in the Egyptian quarantine service familiarized me with the often grossly insanitary conditions due to a lack of sufficiency of cubic

space, absence of thorough ventilation, bad lighting, lack of provision for washing, and primitive privy accommodations in the forecastle of the average ocean tramp passing through the Suez Canal. Even on many passenger ships the accommodation for the crew was such as to explain to some extent the difficulties of getting men for the crew, other than those who simply went to sea either because they had failed to get regular employment ashore, or who, having been tempted to try life afloat, after the glamour had been dispelled by actual experience of the living conditions of a seaman before the mast, either lacked sufficient initiative to get out of it or became inured to their lot.

With regard to accommodation, England, the country which is the greatest shipbuilder, in the merchant shipping act of 1854 required only 72 cubic feet of air space for each seaman. Forty years later, in the act of 1894, in spite of the general advance in hygiene, she did not see fit to extend this accommodation, which, as Dr. Pringle, at the Manchester Conference of Port Sanitary Authorities, last year pointed out, was the accommodation every Briton was entitled to at his own interment. I think that the recommendation of the British Labor Commission that 120 cubic feet should be the standard minimum requirement, and that to secure satisfactory accommodation with such a standard there should be efficient ventilation, preferably artificial, so as to secure perflation of the air, will be generally admitted.

Next to an insufficiency of cubic space and lack of ventilation, I should consider that the water-closets required most attention. Closets should open directly out on deck, with effective ventilation and lighting, and should never be permitted to be in direct communication with sleeping and eating quarters of the crew, or in narrow, dark alleyways. Bunks should not be arranged against the ship's sides, which, together with the roof, should be sheathed with wood or cork. Now that all modern ships have electric motive power and lighting, the crew's quarters should be as well lighted as a deck cabin or a saloon in the case of a passenger ship.

Electric fans and artificial ventilation, especially in ships passing through the Tropics, should be installed on a definite plan or system.

Some shipping companies now trading with Australia, including the New Zealand Union Shipping Co., have on their more recently built ships installed shower baths for the crew. Hitherto on many ships any lavatory accommodation for the crew has been conspicuous by its absence.

Port medical officers can do little by inspection to remedy sanitary defects beyond having the quarters cleaned and drawing attention to minor details which can be altered during the short stay of ships in port.

Any general reform must come from more stringent regulations being enforced at the time of building. As the question of safely housing the crew in the event of collision has drawn attention to the danger of berthing in the fore part of the vessel, it is possible that consideration may be given to provision being made for the crew, either amidships or in the after part of the ship. Already in Norway, which has given a lead to other countries in requiring improvements in accommodation for the crews of ships, this reform has been introduced voluntarily by one of the largest shipping firms.

It is sometimes held that if better quarters for the crew were provided the conditions as to cleanliness would not be improved, owing to a lack of appreciation of that virtue on the part of the men.

It is still true to some extent, as Ruskin says, that "Any interference which tends to reform and protect the health of the masses is viewed as unwarranted interference with their vested rights to inevitable disease and death."

The daily inspection by the master or other responsible officer ought, however, to insure that all quarters be kept clean and wholesome.

As among miners who, as a class, have been almost apathetic hitherto in many countries in taking an interest in improving their often insanitary conditions as to housing, and who at first did not always appreciate the introduction of change houses, and even underground sanitary conveniences, one now sees the awakening of a sanitary conscience, so as the conditions to which sailors have been accustomed were improved there would gradually be an advancement in their standard of personal hygiene, this more especially among the younger men.

FRIDAY AFTERNOON, SEPTEMBER 27, 1912.

THE DISTRIBUTION OF IMMIGRANTS.

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The science of immigration may be said to have grown up in America during the past 25 years; any work previously undertaken, whether in the United States or Canada, having been carried out by governments or by companies, practically with the idea of finding the emigrant, bringing him to America, and then letting nature, chance, and the man's brain and brawn play each its part in his future and his influence upon the community.

The seemingly illimitable western areas made such a method, or absence of method, in the past appear perfectly rational, and on the whole it has resulted in creating, especially in the United States, communities and States where the immigrant, influenced by the native American environment, has become absorbed into the body politic, and a citizen of free Republics, to an extent and with a rapidity never paralleled elsewhere. Thus, the United States Census of 1900 shows in the 12 North Central States a population of over 26,000,000, of which only one-tenth, or 2,079,811, foreign born of voting age was not naturalized, and of this number 8.5 per cent were unable to speak English, and of the children of the foreign born but 2 per cent were unable to read and write.

To much the same extent the process of making Canadian citizens has been and is going on in Canada, which is now receiving nearly 400,000 immigrants annually.

But a change in the outlook upon immigration took place in the United States after 1880, when the demands of agriculture, but especially of industrialism, having largely exhausted the available supply of emigrants from northern Europe, called perforce to the southeastern and southern countries for new supplies. What this has meant is at least in part measured by the percentage growth of the cities as compared with the rural population, as illustrated in the following table:

[From United States census, 1910.]

	Population.				Percentage of distribution.			
	1910	1900	1890	1880	1910	1900	1890	1880
Urban[1]	42,623,383	30,797,185	22,720,223	14,772,425	46.3	40.5	36.1	29.5
Rural	49,348,883	45,197,390	40,227,491	35,383,345	53.7	59.5	63.9	70.5
Total	91,972,266	75,994,575	62,947,714	50,155,733				

[1] Urban unit, 2,500 population.

This accentuation of the urbanizing tendency, especially since 1900, with the slum congestion of cities has in the United States called forth loud protests against immigration in general, while societies for restricting it have been formed and legislative enactments passed, tending, if not to prevent, at any rate to be selective as to the physical, mental, and industrial status of the newcomer. A similar process of selection of immigrants has been gradually evolved in Canada, where immigration has flowed with increasing velocity since 1900; but it was early recognized by the Government that, to populate the immense untilled areas of the western plains, some very definite scheme had to be adopted. To this end the Federal Government formulated a policy of bonusing companies who brought bona fide agriculturists to Canada, and as these western prairies were Federal lands its energies were directed to placing as many immigrants as possible upon homesteads there, under very generous conditions as to residence and cultivation. Special trains, each carrying a Government officer to supervise the needs of the immigrants, went from eastern seaports direct to Winnipeg and a hundred other western centers of settlement, where were immigrant barracks and a land officer of the Government who took a general oversight of the arriving immigrants, directed them to where homesteads could be examined, and generally advised them till settled on the land. The results of the national increase of the population of Canada, and the influx of immigrants during the 1901 and 1911 period, are seen in the following table:

[From Canada Census, 1901–1911.]

	1911	1901	Increase.	Percentage.
Alberta	374,668	73,022	301,646	413.08
British Columbia	392,489	178,657	213,832	119.68
Manitoba	450,614	255,211	200,403	78.52
New Brunswick	351,889	331,120	20,769	6.27
Nova Scotia	492,338	459,574	32,764	7.13
Ontario	2,523,274	2,182,947	340,327	15.58
Prince Edward Island	93,728	103,259	−9,531	[1] 9.23
Quebec	2,002,712	1,648,898	353,814	21.46
Saskatchewan	492,432	91,279	401,153	439.48
Yukon	8,512	27,219	−18,707	[1] 68.73
Northwest Territories	17,196	20,129	−2,933	[1] 15.79

[1] Decrease.

Equally remarkable, as in the United States, is the increase in urban population in Canada in spite of all the efforts made to distribute agriculturists on the land. Thus:

Percentage of urban and rural population in Canada.

	1911	Per cent.	1901	Per cent.	Increase.	Percentage increase.
Urban	3,280,444	45.55	2,021,799	37.6	1,258,645	62.25
Rural	3,924,394	54.33	3,349,516	62.4	574,875	17.16
Total	7,204,838		5,371,315			

It will be seen by comparing this with the preceding table from the United States census, that, in spite of all the efforts of the Canadian Government, the urban increase in Canada has been relatively greater than in the United States, so that the urban percentage ratio of population in Canada is within 1 per cent of being as great as that in the United States.

Percentage of urban to rural population.

	United States.		Canada.	
	1910	1900	1910	1900
Urban	46.3	40.5	45.55	37.6
Rural	53.7	59.7	54.33	62.3
Urban increase	5.8	.....	8.78	.....

Now, however satisfactory, from certain commercial standpoints, these urban increases may appear, yet the fact that the United States cities have had added 11,826,198, and the Canadian cities 1,258,645, or 38 per cent in the one case, and 62 per cent in the other in 10 years, forces upon the United States, and still more upon Canada, a problem remaining as yet largely unsolved. While the number of immigrants annually arriving in Canada at present is nearly five times as great compared with the total population, as in the annual immigration in 1911, to the total population of the United States, making a relatively much larger number to be fed, and proportionately higher prices, yet the disproportion in their distribution, judged by the census figures in both countries demands in Canada, equally with the United States, the most serious inquiry by all sociologists, economists, and statesmen. The situation in both countries is rendered the more acute, inasmuch as the older States and Provinces have again in the last census shown a very serious decline in their rural population.

Percentage of population in the United States in 1910.

Distribution.	Total.	Urban.	Rural.
New England	7.1	12.8	2.2
Middle Atlantic	21.0	32.2	11.3
East North Central	19.8	22.6	17.5
West North Central	12.7	9.1	15.7
South Atlantic	13.3	7.3	18.4
East South Central	9.1	3.7	13.9
West South Central	9.6	4.6	13.8
Pacific	2.9	2.2	3.4
	4.6	5.6	3.7

A similar comparison for Canada is seen in a previous table.

To leave the remedy for this steadily urbanizing process to the immutable laws of nature and competition may have, even 10 years ago,

seemed the logical and inevitable method of correcting social aberrancies, unsound commercial methods, unhealthy individual tendencies to urban life, dislike of manual labor, and the gambling incident to many present-day methods of making a living. But in the light of present-day sociological science this method is no longer tenable or to be defended, since it is evident that if better ways are desirable, and hence possible, they must be found by society and those who represent it. The science of preventive medicine has its place as truly in social maladies as in purely physical ills. Primarily there must be generally disseminated a knowledge of sociological and economic principles. The germ of such already exists in most individuals, whether born in America or Europe, since it is not more than 50 years—and for many immigrants still less—since their fathers were cultivators of the soil, while the hereditary instinct is readily stimulated to turn again to the soil as to a kind mother and as a means of a wholesome livelihood for a man and his family. But it is apparent that if we in the United States and Canada have discovered no means for keeping our own people on the farm it is not probable that we shall make any method tending to this end very successful for the immigrant. This is especially seen in Canada in the case of most English immigrants, among whom the ratio is 4 urban to 1 rural if we adopt the distribution of population in England as the basis. Their lack of the most elementary knowledge of agriculture or experience of rural life has too often resulted in those having even the best intentions drifting to the nearest town after a few ineffective weeks spent in learning to farm. The fact is only beginning to be realized that farming is a science and must be learned as slowly and assiduously as any other business. For immigrants, largely agriculturists from Austria, Italy, and similar countries, the outlook is much more hopeful if steps are taken to provide them with desirable positions in rural occupations after arrival in America, and then by adequate arrangements for profitable and continuous employment to neutralize any tendency to congregate in the congested centers of large cities.

Organized governmental methods and those of private capital for initiating agricultural enterprises along industrial and business lines similar to those of well-managed commercial companies wherein cooperation in the employment of modern machinery, in the employment of effective and cheap power, in buying, storing, and marketing, with the added productiveness of intensive cultivation of small plots devoted to horticulture and orcharding must gradually be worked out, and will then result in assured financial success, social enjoyment, wholesome occupation, and the assurance, maintenance, or evolution of the best ideals of a progressive citizenship and of stability of national character.

SANITARY SERVICE ON SHIPS CARRYING ITALIAN EMIGRANTS.

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TRANSPORTATION OF EMIGRANTS DURING CHOLERA EPIDEMIC IN ITALY.

The arranging of the sanitary service during the recent epidemic of cholera in Italy was certainly the most difficult task that the Commissariato dell'Emigrazione of the Ministry of Foreign Affairs has had to face in the 10 years of its existence.

Since it was desired to maintain emigration uninterruptedly in spite of cholera, it was necessary first of all to devise a means of regulating the movement of masses of emigrants from one region to the other in the interior, and afterwards to prevent, as far as possible, the outbreak of the disease on board ship during the voyage and the repetition of certain disasters well known in the history of mercantile marine.

For the accomplishment of these purposes the Commissariato, from the first appearance of the epidemic in the summer of 1910, had to take special precautions, which grew in importance and intensity during the rest of that year and the next following the greater gravity and extension of the epidemic.

Cholera first made its appearance in Italy in the summer of 1910, in the region of Puglie, and spread thence to Naples and to Palermo. The Commissariato first of all created a station of observation at the port of Naples on board a steamship chartered for the purpose, and to this the emigrants from infected points in Puglie were directed for a period of observation. After this a second ship was made ready in the same port for a like purpose, and later asylums were opened on shore at Naples and Palermo. In this way the Government overcame the enormous difficulties which had been placed in its path by private interests.

In 1911 there were in existence an asylum at Palermo and one at Naples (both of these being on shore), and at Genoa an observation station on a ship in the port. In the latter place, however, the problem was soon simplified by the suspension of emigration for Argentina, which is almost exclusively from this port.

In charge of these stations the Commissariato placed doctors of the Royal Navy, who, in accordance with the law, are also detailed regularly as Royal Commissioners on board ships carrying emigrants.

The doctors of the Marine-Hospital Service attached to the consulates of the United States in Italy had free access to all these stations, in order that they might report to their Government concerning the prophylactic efficiency and value of the stations. Here the emigrants were held under observation for five days, while their baggage was being disinfected and freed from foodstuffs.

The bacteriological examination was limited, in the year 1910, to those of the emigrants who came from Puglie, but in 1911 this examination was extended to all steerage passengers coming from all manifestly infected points.

The time of observation having elapsed the detained passengers were taken directly on board the ships for which they were booked. On each of these ships the water and food supply had been under control, and at the same time the bumboats were restrained by the authorities of the ports, in order to prevent the buying of any suspicious food by the emigrants. Only after all these precautionary measures had been taken was the vessel allowed to start on its ocean trip, laden with its human cargo, although not yet free from danger, as was proved in many instances where cases of cholera occurred during the voyage.

Of these there were, in all, 20; all were on ships bound for North America; and all among the steerage or crew, distributed among 12 vessels; some were in summer, others in the fall; some at the beginning of the voyage, others in midocean, and some even on the last days of the journey.

In 1910 the cases numbered 6, 1 on the *Moltke*, 1 on the *Sant' Anna*, 1 on the *Taormina*, and 3 on the *San Giorgio*. There were 4 deaths on board, the diagnosis being in these cases purely clinical, while on the others the diagnosis was confirmed bacteriologically on arrival at quarantine.

In 1911 there were 14 cases of cholera at sea, distributed as follows: 1 on the *Berlin*, 1 on the *Europa*, 4 on the *Duca degli Abbruzzi*, 1 on the *Moltke*, 1 on the *Venezia*, 1 on the *Koenig Albert*, 4 on the *Re d'Italia*, and 1 again, later, on the *Europa*. All of these cases, 8 of which proved fatal, were found to be positive on examination bacteriologically at quarantine.

Thus it will be seen that on only three ships were there more than one case, viz, on the *San Giorgio*, which sailed from Palermo November 2, 1910, a mother and two daughters becoming ill with cholera on the tenth day of the trip, after having been under observation for five days before sailing; on the *Duca degli Abbruzzi*, leaving Naples June 7, 1911, there were three cases of cholera on the twelfth and thirteenth days of the voyage; on this boat, a few days following departure, a baby 4 months old died of eclampsia, while the cultures from this case, brought by the doctors of the ship and examined upon arrival, proved the disease to be cholera. And finally on the *Re d'Italia*, which sailed from Naples on the 2d of August, 1911, three children died of cholera, and upon arrival a steward, who had been isolated with them and who had been ill and treated as a suspected case during the last days, was found to have the disease.

From the facts submitted the value of the precautions taken by the Commissariato in Italy may be judged, also the rigor of the sanitary service on board the ships under the direction of the military doctors, assisted by the ship surgeons and the officers of the vessels.

SANITARY SERVICE AT SEA.

In some notes published by the Annali di Medicina Navale, in the April number of the current year, I attempted to show how, with an epidemic of cholera spread over all Italy, if emigration is to be maintained without interruption and without great danger to the ships and to the countries to which these ships are destined, an efficient sanitary service at sea is the best safeguard.

Emigrants leave Italy annually on an average to the number of 300,000. These embark at three ports—Genoa, Naples, and Palermo; for the most part from the first two. In the second half of the year 1910 the outgoing emigrants numbered 155,000, this being considered a normal year.

There are, then, 25,000 third-class passengers each month who, during an epidemic extending throughout the country, ought to be subjected to precautionary measures; that is to say, to five days' observation; or, better still, to a bacteriological examination.

Now, if one considers that these people crowd the ports irregularly, following the departure of ships, and that in one day several thousands of steerage passengers ought to be subdivided and examined; and, further, that these, after having been detained and examined, come in contact, while on board, with hundreds of the crew, whom it is practically impossible either to observe or examine, and perhaps, also, with infected cabin passengers, it will not seem strange if I say that our main dependence must be placed on the sanitary service of the ships.

And in the notes above referred to I wrote as follows:

> At sea * * * the disadvantage of a greater agglomeration is more apparent than real, being abundantly compensated by the ventilation of the ship in motion, by the quantity of water at one's disposal in washing decks and walls, and by the absence of flies. And to these must be added the realizing sense in everybody on board of the necessity for discipline; also the ease with which the quantity and quality of water and food can be controlled; and, above all, the facility with which it is possible to rid the ship promptly of all sorts of refuse, the principal fomites of the cholera infection.

An efficient sanitary service of this kind can not be improvised from day to day, and it was fortunate that the Commissariato had such a service already at its command, thanks to the prevision of the emigration law of 1901.

For in this law the Italian Government had clearly designated the number and kind of the sanitary personnel of each ship, and, more

valuable than all, it placed the direction of it under the control of a military doctor.

It is now 10 years since the doctors of the Royal Navy have had to serve in this capacity on emigration steamers, the sanitary service of which they know in minutest detail. So that it was found necessary to give them only a few special instructions, leaving to the initiative of each the provisions in dealing with the new contagious disease, in the event of an outbreak of cholera at sea.

They were, however, under orders to immediately send a wireless, either to Italy or to America, upon the occurrence of cases of cholera on board, so that the fact might be communicated to the quarantine authorities of the United States, that they might make the necessary arrangements while awaiting the arrival of the ship.

Further, thanks to a most opportune agreement between the Italian and American Governments, the royal commissioners received instructions to place themselves completely at the disposal of the sanitary authorities of the quarantine of the United States, and to give all information required concerning the illnesses occurring during the voyage.

Each ship was provided with two small refrigerators, and tubes of culture media, and with the necessary outfit for preserving specimens of vomit or fecal materials for bacteriological examinations by the quarantine laboratories upon arrival. There was no microscopical examination made on board, since, aside from the difficulty of making such an examination, a negative finding would not have excused the commissioner from taking the necessary prophylactic measures on a suspicious case, consequently the practical value of the work would be nil.

From the beginning of the voyage the greatest possible cleanliness was insisted upon, slaked lime being used freely. At the same time a sense of common danger was created among all on board—officials, passengers, and crew—in order that everyone might understand the need of extreme care and cleanliness, and that suspected cases might be reported to the doctor at the earliest possible moment. (It happened, in fact, that many times the emigrants reported one another when the health of any appeared affected.)

Disinfectants were spread freely everywhere—on decks, in lavatories, and especially on the dejecta of the children, who, because of the ease with which their excreta are spread, are the most dangerous carriers of pathogenic organisms.

In addition to the above prophylactic measures, the doctors made frequent night and day visits of inspection to passengers and crew.

On the first appearance of a suspicious case the patient was immediately isolated. On board the ships carrying Italian emigrants it is prescribed that there shall be, always ready for use, besides the two

regular hospitals for common diseases (one for men and the other for women) situated in the middle of the ship, two additional hospitals for contagious diseases, called "Ospedali d'isolamento," which are located at the extreme stern. The number of berths in the hospitals must be at least 3 per cent of the number of third-class passengers which the ship can carry, plus the number of the crew. Two-thirds of these berths are in the hospitals for common diseases and one-third in the hospitals for diseases of infectious nature.

Therefore the isolation of the patient and of his attendants was rigorous. But, knowing that often the appearance of cholera can mean only that there is a carrier on board, redoubled efforts were made to insure cleanliness, disinfection, and watchfulness; and some of my colleagues, to fight the spread of the disease, went so far as to apply corrosive sublimate to the soles of the shoes of the emigrants while the latter were asleep.

In the annual report of the Marine-Hospital Service there is a complete description of all that was done at the quarantines of the United States to prevent the e rance of cholera.

Thanks, therefore, to the -cbautions taken by the Commissariato in Italy and by the authorities of the State and Federal Governments in the United States, and thanks also to the very vigorous and conscientious sanitary service on board the ships, all working together in the most intimate and sympathetic accord, modern hygiene can to-day claim to have rendered possible during a large epidemic of cholera in Italy covering 18 months the transportation to the United States of 222,808 Italian emigrants without either the occurrence of a disastrous epidemic at sea or the invasion of the United States by the disease.

GENERAL CONSIDERATIONS OF SANITARY SERVICE ON BOARD SHIPS.

And now a few considerations concerning the importance that all countries ought to give to the sanitary service on board trans-Atlantic steamers, which transport so many human lives.

It is now 10 years since the Italian law on emigration went into effect, filling a grave want in regulating the transportation of the great masses of emigrants, which, even at that time, were regularly crossing between Italy and the two Americas, completely at the mercy of a few navigation companies.

It was necessary for the legislators to consider the problem from many points of view in order, first, to guarantee to the emigrant the fulfillment on the part of the company of the contract entered into at the time of the selling of the ticket, and, secondly, to assure themselves that the transportation of the steerage would be conducted under conditions best calculated to secure navigation and, more especially, to insure the maintenance of effective hygiene on board. We

find, therefore, in the laws and regulations articles that prevent all possibility of the companies taking advantage of the emigrants, and others specifying definitely the conditions of navigability of the ships and the arrangement of their interiors. Among the last mentioned are those articles establishing the space reserved for each emigrant and regulating the general treatment, others specifying the quality, quantity, and care in the preparation of food; and still others indicating the size of hospitals and dispensary, with the equipment of each, and also the equipment of the pharmacy. The law further provides for the number of doctors and hospital attendants required for each ship in proportion to the number of passengers.

But the Government well knew that even if a ship satisfied all requirements the service at sea could not be guaranteed unless there were on board some one person, independent of the company, in whom the Government could have full confidence and to whom the emigrants could at all times refer their complaints—some one who would, in brief, control the constant application of laws and regulations.

For this purpose it was determined that a doctor of the Royal Navy, of the grade of captain and with the title of Royal Commissioner, who would be invested with the powers and functions of a public official, should accompany each ship on every voyage. This officer is in uniform all the time.

It would seem logical that a doctor should be chosen, instead of an officer of any other corps, when one considers that nearly all of the service on board, even aside from that which is strictly sanitary, is included in the field of public hygiene; for example, cleanliness, the choice of food, its preparation, etc.

The military doctor, except on rare occasions, does not make more than one voyage on the same ship. He embarks two days before departure and leaves the ship two days after the return to Italy, after having assured himself that the prescribed disinfection has been carried out.

On board he is the director of public sanitation, and occupies himself directly with the sanitary service of the emigrants, leaving the ship's surgeon, if there be any, to attend to the cabin passengers and crew.

To the royal commissioner must be referred all cases of illness that occur on board, in order that he may indicate to the captain the precautions to be taken in those cases that are infectious or contagious.

The emigrant soon realizes that there is on board a representative of the law, who has instructions to see that his food is of the proper quality and sufficient in quantity; that to the children are distributed morning and evening milk and special soup; that the water is good and given out in the right quantity and at the right time—a person,

in brief, who is ready to receive his complaints at any time and to give disinterested medical advice.

One must have served in this capacity for years to realize how many diagnoses of constitutional diseases, tumors, etc., are made by these doctors during dispensary hours, when the poor emigrants, especially on the return voyage, come to tell of ills which they had not before been able to confide to any conscientious and disinterested doctor, either in the confusion of great cities or, more particularly, in the isolation of the fazenda and the pampa.

The military doctor keeps a journal of the voyage, and this he turns over to the authorities on his return. In this book are noted the irregularities observed and the instructions given, the complaints received, and the steps taken in the several matters, any failures to comply with regulations, the hours of arrival at and departure from various ports (in order to show whether the ship held throughout the voyage to the medium of speed required), proposals of improvements of any sorts suggested to him by his experience for the protection of the emigrants, etc.

He keeps a sanitary journal also, in which he describes in detail each case of illness and the measures taken; in addition to this he makes a general sanitary report and compiles statistics, and from these documents are afterwards extracted the data to serve for the annual report on emigration published in the Annali di Medicina Navale.

In the most recent of these annual reports made by the colonnello medico, Dr. Rosati, in referring to a normal year of our emigration, we note that the cases of common illnesses among the emigrants on board represented about six and a half per thousand.

This was the year 1910, in which 322,102 emigrants left Italy for the two Americas and 129,323 returned, all in 839 voyages going and coming.

Naturally, however, it is the infectious diseases which most put to task the sanitary service of a ship.

Of the infectious diseases running an acute course, the only ones that appear in the form of small epidemics are measles, varicella, and parotiditis, while diphtheria, erysipelas, smallpox, and meningitis appear in few and isolated cases.

The infectious chronic diseases are more frequent on the return voyages, and in 1910 (exclusive of 36 cases of ankylostomiasis observed in voyages from South America) these chronic infectious diseases were principally malaria, trachoma, and tuberculosis.

Of malaria 365 cases were observed, nearly all of which originated in Italy; many of them were among persons returning from South America.

There were 878 cases of trachoma, almost all of which were returning from South America. Of tuberculosis there were 857 cases, of which 841 were going to Italy.

A good 700 tubercular emigrants came from North America in 1910. All the cases reported had received proper assistance and isolation on board.

But, as I have already said, the activity of this representative of the Government is not limited to the field of hygiene. It would be necessary to read all the voluminous regulations in order to get an exact idea of how far his activity really extends.

For example, he must see that the life belts are always in place on each berth, and that the emigrants are taught to use them; that internal regulations of the ship and discipline are always observed; that the companion ladders and the decks are left free in the space prescribed; that the captain has tables compiled indicating the appointed place of the crew, and also of the officers, for the following drills: man overboard, fire on board, collision with another ship, or running ashore; that the lifeboats are always water-tight, provided with all necessities enabling them to navigate by sails or oars at any time, and that, weather permitting, the captain conducts drills for the manning of lifeboats.

And certainly the presence of these officers contributed to the fact that in the several transfers that took place on the occasion of the collision between the *Florida* and the *Republic* not one man entered the boats until all the women and children of all classes had been provided for.

In this connection it is interesting to note that in the recent *Titanic* disaster 97 per cent of the women of the first class were saved, 84 per cent of the second, and 55 per cent of the third; and while the children of the first and second classes were all saved, of the children of the emigrants there were only 30 per cent. Of all the passengers the figures of the saved are, respectively, 61, 36, and 23 per cent.

Concerning the moral status of the royal commissioner on board, I will only say that while at first he was perhaps not received with much sympathy, soon the more intelligent among the captains regarded with pleasure this representative of the Government, finding his assistance valuable in ridding themselves of the nuisances of some directors who are always and only concerned about the business end, while the captains are willing to conduct their ships according to the best requirements of navigation.

Spain, a country of emigration, has already followed the example of Italy, and it seems now as if Greece, too, would soon act likewise.

It is easy to understand that when a ship is maintained always at a high standard in hygiene and discipline, all on board are benefited.

And it is the crews who after the emigrants derive the most profit, because they also, like the emigrants, need some protection.

It is nowadays generally lamented, more particularly on northern lines, that the recruiting of good crews has become very difficult, and that, instead of men who become attached to the boat, we are obliged to man our ships with a crowd of unfit, inexperienced malcontents.

For several years strikes of the crews have followed closely one after the other, always becoming more menacing, and they will continue, if the matter is not taken in hand by the Governments.

The time of the old type of sailor is past, and just as coal and steel have taken the place of sails and wood, so the common workman (electrician, fireman, and stoker) has taken the place of the sturdy, loyal tar of the old days.

And while on land the ease of organization on one hand and the power of the law on the other give protection to the workman against capital, on board the workman does not enjoy the same amount of protection.

In the last strikes of the marines in England and in the United States there was demanded, besides higher wages, more humane treatment in the matter of lodgings, food, hours of work, and sanitary assistance on board, all of which things are considered by public hygiene; and we all know that capital in any country of the world would attach little importance to hygiene if it were not kept up to the work by the constant enforcement of the laws.

Although the ship surgeons have in some countries succeeded in forming syndicates of resistance against the companies, they are nevertheless always paid by the companies and necessarily bound to their interests. The following incident is of interest in this regard: On one ship last year the royal commissioner diagnosed a case of cholera, isolated it, and took all the precautionary measures, against the advice of the ship surgeon, who reported the matter at quarantine. There the case was found to be positive, and it remained positive for about 40 days.

It is easy to conclude that, however conscientiously these ship surgeons may act under existing conditions, they would accomplish much more in the general interest of the crew and passengers if they were dependents of the Government instead of being at the service of the companies that pay them.

And it is inconceivable how some important companies, even in 1912, are allowed to send out the newest ships, even for a voyage of only 6 days, with but one doctor on board, who, besides having to look after the general hygiene of the ship, is expected to be able to supply the sanitary requirements of 500 first-class passengers, 300 second,

and 1,000 third, and of a crew of 650 men, who are occupied day and night with dangerous work.

So perhaps the day will come soon in which the various Governments who now, thanks to a complete and far-reaching system of sanitation, succeed in controlling hygiene in the smallest villages and humblest factories, will come to some agreement by which every one of these floating cities shall be accompanied at sea by some official person who, being independent of capital, will be able to maintain, in the interest of all, a constantly respectful obedience to the law.

PROBLEMS OF IMMIGRATION FROM A HYGIENIC STANDPOINT.

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METHOD OF HANDLING.

Practically everything respecting immigration statistics prior to the year 1820 may be regarded as guesswork. At all events, there are little or no data of official record pertaining to the subject previous to that time. It has been estimated by statistical writers that the total number of foreigners who landed in this country from 1783 (the year of the foundation of the United States Government) to October, 1819 (when the gathering of immigration statistics commenced), was 250,000, exclusive of negroes. During the first decade following 1783 the estimated annual average was 4,000. This average rose during the succeeding 20 years to 7,000; 1817 must have been the banner year of the period, as 22,240 are said to have arrived during that year.

The different compartments of the ships of those days were of necessity small and contracted. The steerage decks were only 4 or 5 feet in height, and the orlop deck, in which immigrants were also packed, was described by an eminent writer as a "black hole" afloat. "Ten deaths," he says, "for every hundred passengers during the voyage of such vessels was considered healthy, and from 20 to 30 for every hundred not uncommon."

The first immigration law of the United States was passed March 20, 1819. This act provided for the space to be allotted on deck for each passenger, thus determining the carrying capacity of the ship, so far as it concerned the immigrant. Two passengers were allowed for every 5 tons (customhouse measure). The penalty for each and every passenger in excess of this limit was $150. If as many as 20 passengers above the limit were taken on board, the ship or vessel became liable to forfeit to the United States. In addition to the subsistence stores or live stock put on board ship by the masters or pas-

sengers for their own use or that of the crew, 60 gallons of water, 100 pounds of salt provisions, 1 gallon of vinegar, and 100 pounds of wholesome ship's bread was to be provided for each and every passenger embarking at an European port on voyage to the United States. Provision was also made by this early act for the delivery by the captain or master of a list or manifest of all passengers, giving age, sex, and occupation of the passengers, showing the country whence they came and of which they intended to become inhabitants; also whether any deaths occurred on board during the voyage. Nothing was said as to the hygienic condition of the ship nor as to the cooking of the food; whether to be served cooked or not. This law continued in force for many years, but much improvement (in the law) was effected by the act of Congress approved February 22, 1847. It is written, however, that the Bremen authorities, about the year 1830, were the first to require the masters of ships to furnish cooked rations for their passengers. Previous to that time all immigrants, and for several years subsequently all except Bremen immigrants, were required to provide themselves with food and to cook it as best they could. Under such conditions it is not to be wondered at, as we read, that many embarked with an insufficient supply of provisions, some with none at all, and that even those who had a sufficient supply of food in the raw state suffered greatly because of the lack or inadequacy of cooking facilities, and because of the duration of the voyage all fell short and were obliged to go hungry or die before they reached the land of promise.

The act of 1847 required for each and every passenger 14 clear superficial feet of deck (20 feet if in the Tropics) for each passenger and 30 clear superficial feet if carried on an orlop. The penalty for violation was somewhat less than that of the earlier act, being only $50 for each and every passenger, but including also imprisonment for not exceeding one year, and vessels forfeited to the United States if limit was exceeded by 20. All berths for vessels having more than two tiers were to be "at least 6 feet in length, 18 inches in width, and well constructed." The space between the floor and deck or platform had to be at least 6 inches. Two children, each less than 8 years of age, to equal one passenger; those under 1 year not to be counted (not included in the computation). But this latter provision as to two children counting for one passenger only in the assignment of room or space was repealed within 10 days after it was enacted. However, "from data accessible for the year 1847," says Dr. Bell, "the number of immigrants who died on the voyage and at hospitals during that year from ship's fever was estimated at 20,000, but during this same year the ships from Bremen and Hamburg were comparatively free from such disease." Further and more remarkable advance in ship hygiene was effected the next

year by the act of Congress approved May 17, 1848. Ventilators were required by this law for the rooms or spaces occupied by the passengers, also houses over the hatchways with doors and windows leading to the decks below; the quantity and variety of food supplies increased, a cooking range of proper size had to be installed on board, and the quantity of food to be supplied daily was specified.

The quantity of food provided for each passenger for the voyage was to be at least 15 pounds of navy bread, 10 pounds of rice, 10 pounds of oatmeal, 10 pounds of wheat flour, 10 pounds of peas and beans, 35 pounds of potatoes, 1 pint of vinegar, 60 gallons of fresh water, 10 pounds of salt pork free of bone. To guard against a poor market, substitutes for some of these articles were also specified. Good discipline was to be maintained, and habits of cleanliness encouraged, so as to preserve and promote the health of all on board. In good weather all bedding was aired and the passengers mustered on deck. A privy for every hundred passengers and the cleansing of the decks with chloride of lime or other disinfectant were further improvements.[1] The superficial deck area for each passenger was also somewhat increased by this act.

The act of March 3, 1849, was for the protection of voyagers between ports of the Atlantic and Pacific Oceans, and required the captain to furnish a daily supply of water for all on board; also to furnish or cause the passengers to furnish for themselves a sufficient supply of good wholesome food.

The act of March 3, 1855, was in the line of further improvement, not only as regards the cooking of food and its distribution, but vessels carrying passengers were required to include food and cooking in the price of transportation, the sick were cared for in separate compartments (hospitals), berths of only two tiers were allowed, provision was also made for the ventilation of the steerage, and the use of the orlop deck as a carrier of passengers was discontinued.

Another and more important improvement was also brought about at this time, in that steamships began to take the place of sailing ships in the passenger traffic, but the law applied alike to vessels propelled in whole or in part by steam. The change came about very gradually but steadily until about 10 years later, when practically all sailing-ship immigration gave way to the more rapidly going steamship. And it was about this time, too (in the years 1852, 1855, and 1863), that laws were passed by the British Parliament governing the transportation of passengers by sea, and providing amongst other things for an abundance of wholesome cooked food, for the carrying of passengers on two decks only, and requiring the sexes to be berthed separately; limiting the number of passengers on the upper deck to one statute adult for every 15 clear superficial feet of deck, and on the lower deck one to every 18 clear superficial feet;

providing also that, if the space between such lower passenger deck and the deck immediately above be limited to less than 7 feet, or if other conditions pertaining to the admission of light and air through apertures be unfavorable, the allowance be not less than in the proportion of one statute adult to every 25 clear superficial feet of deck; and further, for wholesome regulations, rigid discipline, and penalties, and their enforcement by competent officers; also for the employment of qualified physicians on board. This may be properly regarded as one of the first steps in the consideration of marine hygiene as applied to ships carrying passengers.

The act approved March 24, 1860, as stated by Dr. Turner,[2] from whose excellent reports much of this matter is taken, "was made for the better protection of female immigrants, and is creditable to the chivalry of the framer." Imprisonment for a term of 12 months or a fine not exceeding $1,000 was imposed by this act upon every officer, seaman, or other person employed on board of any ship or vessel of the United States who should be found guilty of wrongdoing with any female passenger. Visiting or going into any part of the ship occupied by passengers, except by direction of the master or commander, was forbidden under punishment of forfeit of wages for the voyage. If the captain gave permission for any unnecessary visit of this kind, he was to be fined $50 for each time he directed or permitted such violation of this section of the law. The law also required that written or printed notice containing the provisions of this act in the English, French, and German languages be posted and kept posted in different parts of the ship during the voyage, and imposed a fine of $500 for violation of this section. The amount of the fine, when collected, at the discretion of the court, was "to be paid for the use or benefit of the female, her child, or children, if any." Conviction, however, could not be had on the uncorroborated testimony of the woman. Twenty years later, according to the authority already quoted, these salutary acts remained unexecuted on the statute books, and the ships, he said, were a disgrace alike to the captain and to the owner.

A voyage across the Atlantic in the early days was indeed attended by great hardship, not only because of the insufficiency of food, or of food unfit for consumption, but also on account of the overcrowded immigrant ship.

There was no law of the United States limiting the number of passengers a ship should be permitted to carry, or prescribing any measures whatsoever for the health or comfort of the immigrant during the voyage, until March 2, 1819, when the law with such object in view was passed. But at this time, as also of later date, hygienic measures were not rigidly enforced. The collecting and compiling of statistics dates, however, from that time, or rather from the begin-

ning of the fiscal year 1820. But very little if any supervision was exercised over immigration at New York during the next quarter of a century, except such as was provided by the general quarantine and poor laws. The head tax was collected on all passengers arriving at New York, and the fund thus created was applied to the support of the marine hospital at quarantine, where immigrants sick on arrival were cared for, but even this relief was denied them after landing, unless perchance they took up the vocation of a sailor, and in that way became a beneficiary of the marine hospital. Because of the long and tedious voyage and the hardships endured, public charges were relatively quite numerous. Indemnifying bonds were sometimes required as a protection to the city or county in the event of the immigrant becoming a public charge; but bonds of this character required by the local authorities were of comparatively little value in affording relief to the diseased or destitute alien, nor for his protection against fraudulent boarding-house keepers or street hawks. Going west in those days meant transportation by the Hudson River steamboat and Erie canal boat to Buffalo (although the railroad between Albany and Buffalo was nearing completion about this time).

In 1847 a law was enacted by the State legislature creating a board of commissioners of immigration of the State of New York. Under this law the master of the ship bringing immigrants to the port of New York was required to report to the mayor the name, nativity, last legal residence, age, sex, and occupation of each immigrant, "whether any were lunatics, deaf, dumb, blind, infirm, maimed, above 60 years of age, or under 13 years of age." This act also required the giving of bonds by the shipowners to indemnify county, city, or town authorities, for any expense incurred for the relief of destitute aliens; also for the care and maintenance of any person named in bond if received into the marine hospital or any other institution under their jurisdiction. Provision was also made whereby owners could commute for bonds by paying a head tax on all but prohibited passengers. The State commission was organized May 8, 1847, with office accommodations in the old Almshouse Building in New York City. In 1854 this building was destroyed by fire and an office was then established in Franklin Street, between Broadway and Elm. About this time cholera appeared in the city, causing much trouble and great fear amongst the inhabitants and necessitating a change of office location. For several years an old church building in Anthony Street (now Worth Street, near Broadway) was leased by the commission for office use. In 1858 Castle Garden, the old fort (now the Aquarium), was leased by the State (under act of the legislature of 1855) and opened as a landing station for immigrants. The hospital and detention accommodations were on Ward's Island. Immigration matters were carried on and expenses met in

this fashion for a number of years until 1876, when the State law relative to immigrant head tax was declared unconstitutional.

During the next six years the expenses of the commission were met by State appropriations, although the State legislature, at the time the head tax was abolished, adopted a resolution instructing the commissioners of immigration "to call the attention of the Congress of the United States to the present condition of the immigration laws resulting from the decision of the Supreme Court of the United States, declaring the State laws on the subject unconstitutional and void, and to impress upon Congress the necessity for speedy National legislation in regard thereto, and that the said commission take such steps as in their judgment may be appropriate to secure such legislation." Five years later a law was passed by the United States Congress (act approved Aug. 3, 1882) to regulate immigration. This act provided for a head tax of 50 cents for each passenger not a citizen of the United States who came here from a foreign port. The money thus collected was to be used in meeting the expense of regulating immigration and for the relief and care of distressed immigrants, and authorized the Secretary of the Treasury to enter into contract with State officials for the performance of the immigration work of the station. Eight years later (in 1890) the contract between the Secretary of the Treasury and the State immigration commission was revoked, a United States commissioner was placed in charge, and the Federal Government assumed control of all immigration affairs. By act of Congress (approved Mar. 3, 1891) the office of superintendent of immigration was created and established. The said official was to be appointed by the President and to have office in Washington, D. C., under control and supervision of the Secretary of the Treasury. By this act all the duties and responsibilities contemplated by the act of 1882 for State commissioners were conferred upon Federal officers. The year 1891 may therefore be regarded as the beginning of the United States Immigration Service proper. The excluded classes under this act were idiots, insane persons, paupers, persons likely to become a public charge, or persons suffering from a loathsome contagious disease. This act also required the captain or commanding officer or agents of steam or sailing vessels by which they came to the port, to report to the proper inspecting officer the name, nationality, last residence, and destination of any such alien; it also provided for a fine of $1,000, or imprisonment for one year, for any person violating its provisions.

Castle Garden was now abandoned as an immigrant landing station, and the Barge Office, or rather the Barge Office Annex at the Battery, was put into commission, having previously been fitted up for the purpose pending the contemplated construction of buildings at Ellis Island. The old steamship *Narragansett* was chartered by

the Government, anchored near Ellis Island, and used as a detention station, and a contract was entered into with the Long Island College Hospital, in Brooklyn, for the necessary accommodations for the sick and injured.

The Ellis Island buildings were completed and put into commission in January, 1892. All the immigration-inspection work was conducted there until June 14, 1897, when, early in the morning (soon after midnight), the buildings were destroyed by fire, together with many valuable records and manifests containing names and important data pertaining to immigrants landed at New York from 1847 to 1890. There were many immigrants on the island at the time, some in hospital and others in the dormitories of the main building; but, owing to the efficiency of the medical staff and the excellent discipline of the night force under direction of Dr. J. H. White, the surgeon then in charge of the medical department, no lives were lost. The sick were transferred to Bellevue Hospital, and the contract was then also renewed with the Long Island College Hospital for the care and maintenance of sick aliens. After this fire the Barge Office was again brought into requisition and put to use as a landing station until 1900, when the new main building at Ellis Island was ready for occupancy.

The next immigration law (act approved Mar. 3, 1893) is entitled "An act to facilitate the enforcement of the immigration and contract-labor laws of the United States." Among the important changes and improvements effected by this law are the manifest and group list of 30 names with full particulars as to each individual immigrant, the identification cards, etc. This law also provided for boards of special inquiry, consisting of four officers acting as inspectors, to whom are referred all immigrants not clearly and beyond a doubt entitled to land; the manifest sheets to be made by the commanding officer at the time and place of embarkation, and to give for each immigrant the full name, age, sex, whether married or single, able to read or write, nationality, last residence, especially if landing in the United States, final destination, if any, beyond the seaport of landing; not more than 30 names on one list, and in convenient groups; the list to be verified by signature and oath of the master or chief officer, taken before a United States consul at port of departure, that he has made a personal examination of the passengers named therein, and has caused the ship's surgeon to examine each passenger; that from his personal inspection and the report of the surgeon he believes that no one of said passengers is an idiot or insane person, a pauper, or a person likely to become a public charge, or one suffering from a loathsome contagious disease. The surgeon also was required to sign and make oath to the manifests as stated,

and failure to deliver such list concerning all immigrants on board involved a fine of $10 for each immigrant about whom such information was not given. A book of rules and regulations was now also issued and promulgated by the Secretary of the Treasury for the guidance of immigration officers in the performance of their important duties.

During the next 10 years several acts of Congress were passed bearing upon some questions of immigration and the enforcement of contract-labor and Chinese-exclusion laws.

In February, 1903, the law was passed (act approved Feb. 14, 1903) establishing the Department of Commerce and Labor and providing for the appointment of a Secretary and an Assistant Secretary of Commerce and Labor and for the transfer from the Department of the Treasury to the Department of Commerce and Labor of a number of the most important offices, bureaus, and divisions, including the "Commissioner General of Immigration, the commissioners of immigration, the Bureau of Immigration, and the Immigration Service at large."

The next important law in chronological order is the act approved March 3, 1903, entitled "An act to regulate the immigration of aliens into the United States." This act is composed of 39 articles or sections and provided for the collection of $2 for each and every passenger not a citizen of the United States or of the Dominion of Canada, the Republic of Cuba, or the Republic of Mexico who shall come by steam, sail, or other vessel from any foreign port to any port within the United States. The money thus collected was to constitute a permanent appropriation to be called the "immigrant fund," to be used under the direction of the Secretary of the Treasury to defray the expenses of regulating the immigration of aliens into the United States under this act.

Section 2 directs the exclusion of all idiots, insane persons, epileptics, and persons who have been insane within five years previously; persons who have had two or more attacks of insanity at any time previously; paupers; persons likely to become a public charge; professional beggars; persons afflicted with a loathsome or dangerous contagious disease; persons convicted of a felony or other crime or misdemeanor involving moral turpitude; polygamists; anarchists; * * * prostitutes, or women for the purpose of prostitution; those who have within one year from date of application for admission to the United States been deported as being under offers, solicitations, promises, or agreements to perform labor or service of some kind therein. * * * Exceptions were made, under certain conditions, for skilled labor, and the provisions of the law were not to be held to exclude professional actors, artists, lecturers, singers, ministers of any religious denomination, professors of colleges or seminaries, persons belonging to any recognized learned profession, or persons employed strictly as personal or domestic servants.

Sections 3 to 16 impose imprisonment of not less than one year nor more than five years, and a fine of not exceeding $5,000, on whoever shall import or attempt to import any woman or girl into the United States for the purposes

above stated; also a fine of like amount against violation of the contract-labor laws referred to in said sections, and a fine of $1,000, or imprisonment, against any person for bringing into, or attempting to land in, the United States any alien not duly admitted by an immigrant inspector or not lawfully entitled to enter the United States.

Provision is also made that there shall be paid to the collector of customs $100 for each and every alien afflicted with a loathsome or a dangerous contagious disease, if it shall appear to the satisfaction of the Secretary of Commerce and Labor that the existence of such disease might have been detected by means of a competent medical examination at the time of foreign embarkation; and no vessel shall be granted clearance papers while such fine imposed upon it remains unpaid; and, upon the certificate of a medical officer of the United States Public Health Service to the effect that a rejected alien is helpless from sickness, mental or physical disability, or infancy, if such alien is accompanied by another alien whose protection or guardianship is required by such rejected alien, the master, owner, or consignee of the vessel in which such alien and accompanying alien are brought shall be required to return said alien and accompanying alien in the same manner as vessels are required to return other rejected aliens.

Provision is also made, amongst other things, for the delivery to the immigration officers at the port of arrival of lists or manifests, made at the time and place of embarkation, giving full particulars, as per section 2, regarding each and every alien on board vessel; said lists to be verified by signature and affidavit of the master or commanding officer; also, by the ship surgeon, as to the physical or mental condition of the aliens; that, according to the best of his knowledge and belief, no one of them is an idiot or insane person, or is suffering from a loathsome or dangerous contagious disease. A fine of $10 is imposed for each alien concerning whom the information required is not contained in the manifest.

Section 17 relates to the physical and mental examination of arriving aliens by medical officers of the Public Health Service.

This section and a number of the other 39 sections of this act are reenacted in the succeeding law (Feb. 20, 1907), bearing the same title, "An act to regulate the immigration of aliens into the United States." This act contains 44 sections, varying in quantity from 32 to 600 words, and covering practically all existing law pertaining to immigration proper, although a law was passed 10 days later (act of Mar. 2, 1907) in reference to the expatriation of citizens and their protection abroad.

For the purposes of this paper, therefore, the sections of law hereinafter referred to, or, rather, the brief extracts of same, unless otherwise specifically stated, apply to the act of February 20, 1907.

Section 1. This section provides for the collection of a head tax of $4 for every alien entering the United States, * * * the money thus collected, together with all fines, etc., to constitute a permanent appropriation, called the immigrant fund, to be used under the direction of the Secretary of Commerce and Labor to defray the expense of regulating immigration under the laws, including the contract-labor law, * * * provision is made, however, that if the amount of money collected in any fiscal year shall exceed $2,500,000, the excess above that amount is not to be added to the immigrant fund * * *.

Section 2. This section requires, amongst other things, that the following classes of aliens shall be excluded from admission into the United States: All idiots, imbeciles, feeble-minded persons, epileptics, insane persons, and persons who have been insane within five years previously; persons who have had two or more attacks of insanity at any time previously; persons likely to become a public charge; professional beggars; persons afflicted with tuberculosis or with a loathsome or dangerous contagious disease; persons not comprehended within any of the foregoing excluded classes who are found to be and are certified by the examining surgeon as being mentally or physically defective, such mental or physical defect being of a nature which may affect the ability of such alien to earn a living; persons who have been convicted of or admit having committed a felony or other crime or misdemeanor involving moral turpitude; polygamists * * * anarchists * * * prostitutes * * * persons who procure or attempt to bring in prostitutes or women or girls for the purposes of prostitution * * *.

Section 3. The importation of any alien woman or girl for the purpose of prostitution is forbidden * * * under penalty of imprisonment of not more than five years and of a fine of not more than $5,000 * * *. Any alien woman or girl practicing prostitution at any time within three years after arrival shall be deemed to be unlawfully within the United States and shall be deported.

Section 9. Imposes a fine of $100 against the bringing into the United States of any alien subject to any of the following disabilities: Idiots, imbeciles, epileptics, or persons afflicted with tuberculosis or with a loathsome or dangerous contagious disease, if it shall appear to the satisfaction of the Secretary of Commerce and Labor that any alien so brought to the United States was afflicted with any of the said diseases or disabilities at the time of foreign embarkation, and that the existence of such disease or disability might have been detected by means of a competent medical examination at such time * * *.

Section 10. This section provides that the decision of the board of special inquiry, hereinafter provided for, based upon the certificate of the examining medical officer, shall be final as to the rejection of aliens affected with tuberculosis or with a loathsome or dangerous contagious disease, or with any mental or physical disability which would bring such aliens within any of the classes excluded from admission to the United States under section 2 of this act.

Section 13. This section requires that all aliens arriving by water at the ports of the United States shall be listed in convenient groups, and no one list or manifest shall contain more than 30 names. To each alien or head of a family shall be given a ticket on which shall be written his name, a number or letter designating the list in which his name is contained, and his number on said list, for convenience of identification on arrival, the list or manifest to be verified by oath or affirmation of the master or commanding officer, and also by the surgeon, the same as also provided for in preceding law.

Section 19. Under this section all aliens brought to this country in violation of law shall, if practicable, be immediately sent back to the country whence they respectively came on the vessels bringing them. The cost of their maintenance while on land, as well as the expense of the return of such aliens, shall be borne by the owner or owners of the vessels on which they respectively came; and if any master, person in charge, agent, owner, or consignee of any such vessel shall refuse to receive back on board thereof, or on board of any other vessel owned or operated by the same interests, such aliens, or shall fail to detain them thereon, or shall refuse or fail to return them to the foreign port from which they came, or to pay the cost of their maintenance while on land, or shall make any charge for the return of any such alien, or shall take any secur-

ity from him for the payment of such charge, such master, person in charge, agent, owner, or consignee shall be deemed guilty of a misdemeanor and shall, on conviction, be punished by a fine of not less than $300 for each and every such offense * * *. No alien certified to be suffering from tuberculosis or from a loathsome or dangerous contagious disease, other than one of quarantinable nature, shall be permitted to land for medical treatment thereof in any hospital in the United States unless with the express permission of the Secretary of Commerce and Labor: *Provided*, That upon the certificate of a medical officer of the United States Public Health Service to the effect that the health or safety of an insane alien would be unduly imperiled by immediate deportation, such alien may, at the expense of the "immigrant fund," be held for treatment until such time as such alien may, in the opinion of such medical officer, be safely deported.

Under section 20 provision is made for the deportation of any alien who has entered the United States in violation of law or who has become a public charge from causes existing prior to landing at any time within three years after the date of entry into the United States * * *.

Section 21. When, in the opinion of the Secretary of Commerce and Labor, the mental or physical condition of such alien is such as to require personal care and attendance, he may employ a suitable person for that purpose, who shall accompany such alien to his or her final destination, and the expense incident to such service shall be borne by the owner or owners of the vessel on which alien came.

Section 24. * * * Every alien who may not appear to the examining immigrant inspector at the port of arrival to be clearly and beyond a doubt entitled to land shall be detained for examination in relation thereto by a board of special inquiry.

Section 25. * * * Each board shall consist of three members * * *. The decision of any two members of the board shall prevail, but either the alien or any dissenting member of the board may appeal through the commissioner of immigration and the Commissioner General of Immigration to the Secretary of Commerce and Labor, and such appeal shall operate to stay any action in regard to the final disposal of any alien until the receipt of said decision by the commissioner of immigration at the port of arrival * * *, but nothing in this section shall be construed to admit of any appeal in the case of an alien rejected as provided for in section 10 of this act.

Section 26. In the discretion of the Secretary of Commerce and Labor, any alien liable to be excluded because likely to become a public charge or because of physical disability other than tuberculosis or a loathsome or dangerous contagious diseases may, if otherwise admissible, nevertheless be admitted upon the giving of a suitable and proper bond, approved by said Secretary, in such amount and containing such conditions as he may prescribe * * *.

Section 30. This section provides, amongst other things, that no intoxicating liquors shall be sold in any United States immigration station.

Section 32. This section directs that rules shall be prescribed for the entry and inspection of aliens along the borders of Canada and Mexico * * *.

Under section 39 of this act an Immigration Commission was created, consisting of nine members, and provision made for their appointment as follows: Three Senators, appointed by the President of the Senate; three Members of the House of Representatives, appointed by the Speaker of the House, and three persons appointed by the President of the United States; said commission to make full

inquiry, examination, and investigation into the subject of immigration. The commission being authorized to make all necessary travel, either in the United States or through foreign countries, and to employ all necessary clerical and other assistance, all necessary sums of money were appropriated and authorized to be paid out of the "immigrant fund" on the certificate of the chairman of said commission, including all expenses of the commission, and a reasonable compensation, to be fixed by the President of the United States, for those members of the commission who were not Members of Congress.

The Immigration Commission referred to organized in April, 1907, and continued until December, 1910, when a report consisting of 42 volumes was made to Congress. The following statement regarding the commission and its work was kindly furnished me by Mr. W. W. Husband, the secretary of the commission:

The commissioners appointed were Senators Dillingham, Vermont (chairman); Lodge, Massachusetts; Latimer, South Carolina; Representatives Howell, New Jersey; Bennet, New York; Burnett, Alabama; Dr. Charles P. Neill, District of Columbia; J. W. Jenks, New York; and William R. Wheeler, California. The commission organized in April, 1907, and continued until December, 1910, when a final report to Congress was made. The commission's report, which consists of 42 volumes, deals somewhat with emigration conditions in Europe and the treatment of immigrants en route to the United States, but is mainly devoted to data collected in an extensive investigation of conditions existing among recent immigrants in this country. This investigation embraced immigrants in industries and agriculture, the congestion of immigrants in cities, the children of immigrants in schools, immigrants as charity seekers, immigration and crime, immigration and insanity, the white-slave traffic, immigrant homes, immigrant banks, and various other agencies, both good and evil, that frequently play an important part in the early life of immigrants in the United States. The commission concluded that the immigration movement in the main is well regulated; that the immigrants physically are strong and healthy; that there are few paupers among them; and that criminality is relatively not more prevalent among immigrants than among natives. In fact, the present immigration was given a pretty clean bill of health in most particulars. Nevertheless the commission unanimously recommended that immigration be restricted, such restriction to apply to the numerous class of unskilled laborers who come without families, having no intention of remaining permanently, and who will while here accept low wages and adopt a standard of living which makes them unfair competitors of American industrial workers. This conclusion was reached as the result of an investigation in upward of 200 industrial communities in which inquiry data concerning 700,000 industrial workers and 25,000 industrial families were secured.

Section 41 says "that nothing in this act shall be construed to apply to accredited officials of foreign governments, nor to their suites, families, or guests."

Section 42. This section is amendatory to the navigation act, and reads as follows:

"It shall not be lawful for the master of a steamship or other vessel whereon immigrant passengers, or passengers other than cabin passengers, have been

taken at any port or place in a foreign country or dominion (ports and places in foreign territory contiguous to the United States excepted) to bring such vessel and passengers to any port or place in the United States unless the compartments, spaces, and accommodations hereinafter mentioned have been provided, allotted, maintained, and used for and by such passengers during the entire voyage; that is to say, in a steamship, the compartments or spaces unobstructed by cargo, stores, or goods, shall be of sufficient dimensions to allow for each and every passenger carried or brought therein eighteen clear superficial feet of deck allotted to his or her use, if the compartment or space is located on the main deck or on the first deck next below the main deck of the vessel, and twenty clear superficial feet of deck allotted to his or her use for each passenger carried or brought therein, if the compartment or space is located on the second deck below the main deck of the vessel: *Provided*, That if the height between the lower passenger deck and the deck immediately above it is less than seven feet, or if the apertures (exclusive of the side scuttles) through which light and air are admitted together to the lower passenger deck are less in size than in the proportion of three square feet to every one hundred superficial feet of that deck, the ship shall not carry a greater number of passengers on that deck than in the proportion of one passenger to every thirty clear superficial feet thereof. It shall not be lawful to carry or bring passengers on any deck other than the decks above mentioned. And in sailing vessels such passengers shall be carried or brought only on the deck (not being an orlop deck) that is next below the main deck of the vessel or in a poop or deck house constructed on the main deck; and the compartments or space, unobstructed by cargo, stores, or goods, shall be of sufficient dimensions to allow one hundred and ten cubic feet for each and every passenger brought therein. And such passenger shall not be carried or brought in any between decks nor in any compartment, space, poop, or deck house, the height of which from deck to deck is less than six feet. In computing the number of such passengers carried or brought in any vessel, children under one year of age shall not be included, and two children between one and eight years of age shall be counted as one passenger; and any persons brought in any such vessel who have been during the voyage taken from any other vessel wrecked or in distress on the high seas or have been picked up at sea from any boat, raft, or otherwise, shall not be included in such computation. The master of a vessel coming to a port or place in the United States in violation of either of the provisions of this section shall be deemed guilty of a misdemeanor; and if the number of passengers other than cabin passengers carried or brought in the vessel or in any compartment, space, poop, or deck house thereof is greater than the number allowed to be carried or brought therein, respectively, as heinbefore prescribed, the said master shall be fined fifty dollars for each and every passenger in excess of the proper number, and may also be imprisoned not exceeding six months.

"This section shall take effect on January first, nineteen hundred and nine."

New York is the port of arrival for about 75 per cent of the total number of immigrants entering the United States—1,017,155 came during the fiscal year ended June 30, 1912, and 726,040 of these arrived at New York, nearly three times as many as at all other ports of the country combined. Twenty-six per cent were cabin passengers and 74 per cent came in the steerage. In addition to the 726,040 aliens 179,306 cabin and steerage passengers arrived who, after primary inspection, proved to be citizens of the United States. The total

number of arrivals at New York for the year named was about 2.63 per cent and in the country at large about 1.28 per cent less than the number recorded for the preceding year.

Nineteen hundred and seven (1907) was the record-breaking year of immigration, 1,285,349 arriving during that year. But the years 1905, 1906, and 1910 also passed the million mark. And the records of the past 40 years show a heavy annual immigration, 21,387,218 alien immigrants having arrived in this country during that period, an average of 534,680 a year. During these 40 years immigrants have come from nearly as many countries, and the foreigners now in the United States represent more than 30 different races or peoples.

It is not within the scope of this paper to recite the proportion or relative proportion of arrivals from all the different countries, interesting as the compilation of such statistics might be. It is a strikingly significant fact, however, that during the first half of the 40-year period referred to, and for many years prior to that time, by far the largest number came from the German Empire. More than 25 per cent of the total immigration from Europe was German. No other country was even a close second, although large numbers also came from the United Kingdom (England, Ireland, Scotland, and Wales) and from Scandinavia (Norway, Sweden, and Denmark). Southern Europeans, especially Italians, were in evidence, but it was not until about the year 1885 that Italy began to take the lead and to assume the position formerly held by the German Empire in adding, though less permanently, to the population of the United States. This position Italy has steadily held since that time, dividing the honor, however, during the last decade with Austro-Hungary and the Russian Empire.

The total arrivals from countries in Europe during these 10 years (to June 30, 1911) aggregated nearly 9,000,000. Of this number Italy, including Sicily and Sardinia, furnished more than 2,000,000, nearly 1,000,000 came from the United Kingdom, and about 100,000 each from France and the Netherlands; 50,000 from Spain, and a less number from Switzerland. During this same period, however, the German arrivals numbered upward of 500,000, and the Scandinavian more than 300,000. In the race statistics, the Southern Italians head the list, but their number is only slightly in excess of the Hebrews, chiefly from Russia and Austro-Hungary, and these races, together with other southern and eastern Europeans and western Asiatics, constitute about 70 per cent of our total immigration for the past 10 years.

There is, however, a considerable reverse current. During the year 1908 the ratio of departures (emigration) to the number of arrivals (immigration) was more than 77 per cent. The annual average has been above 50 per cent.

The problem of handling immigrants may be said to begin at the time of embarkation or, in other words, as soon as the immigrant steps aboard ship and the vessel weighs anchor. He then becomes a denizen, so to speak, of that little floating world of which the master of the ship is the supreme ruler. But under the master, and in the interest of all concerned, the ship surgeon exercises, or is supposed to exercise, such surveillance over all the people on board as will tend to prevent the development of any disease seriously affecting the individual passenger or make him a menace to other passengers on the ship. He is also expected to guard against the contracting or to ascertain the presence of any disease or defect which would be likely to interfere with the landing of the alien at the port of arrival, and incidentally also avoid the fine for not reporting the same on the ship's manifest or the ship surgeon's report.

The majority of the immigrants on board, being third-class or steerage passengers, are assigned to quarters of the same designation. In the old ships they had what was called open steerage. During the day these passengers mingled together quite freely, but about 8 o'clock in the evening the sexes were separated into different compartments, the line of demarcation being a bulkhead or substantial partition. The sleeping accommodations consisted of bunks arranged in tiers. These, however, were not inclosed after the fashion of the cabin accommodations. They were simply separated by easily removable wooden partitions.

The next considerable improvement was effected through the development of the "compartment steerage" accommodations. In these the steerage section of the ship is divided into compartments chiefly for the purpose of separating the sexes. The single men forward, single women aft, and families are also kept together in separate compartments, and there is, or is supposed to be, no mingling during the voyage. This arrangement also serves another useful purpose in that contagious disease may be confined to the compartment where it originates. The sleeping accommodations consist of inclosed sections or rooms containing from 6 to 10 bunks. But in the later and better constructed ships there is practically no steerage as the term was formerly understood. The third-class accommodations in these modern vessels are practically the same or even better than the cabin quarters in many of the older ships, and the tendency now seems to be, on these floating palaces, to discontinue the use of the term "steerage" in favor of "third class" or, if further divided, "fourth class." The rooms contain from four to six berths each, but in other respects are similar to the cabin accommodations proper.

It is the duty of the ship surgeon to make a daily inspection of all the immigrants, and the stewards are also instructed to keep a

lookout for and report signs of illness observed among the passengers. Any case of illness detected is at once removed to the ship's hospital or, if of a contagious nature, to a room separate and apart from other patients who may be confined in the hospital, and the quarters from which the patient is removed disinfected. Every case of illness is noted on the ship surgeon's report, and a transcript of the report is handed first to the quarantine officer on arrival at the outer harbor, where the quarantine is usually located, and next to the immigrant inspector or the medical examiner of immigrants (public health officer), who, together with a customs officer, boards the ship as soon as it is released or given pratique at quarantine, and the cabin passengers are then examined on the way up to the dock. The customs officer inspects, amongst other things, the immigrant quarters for the purpose of seeing whether the navigation laws are carried out. Each immigrant bears an inspection card, and the surgeon checks or punches thereon the date of each daily inspection, so that at the end of the voyage the checked card must tally with the number of days at sea. The captain also makes a daily round for the purpose of observing the condition of the ship and, if necessary, of enforcing any hygienic or other measures prescribed by the surgeon or otherwise brought to his attention.

The dining accommodations on the old "open steerage" ships were very poor. Each immigrant or head of a family was provided with a basin or pan or receptacle of some kind, and was obliged to go to the kitchen for his or their measure of food. In the newer and better ships the conventional dining room and tables are in use, and the food is served more in accordance with a higher degree of civilization.

The process of cleaning ship usually begins in the morning after the immigrants have gone to breakfast. The sleeping quarters are washed down and scrubbed with disinfectant solutions and the floors and alleys are flushed. Everything in these quarters is supposed to be "spick and span" before the immigrants are allowed to return to them. After disembarkation the bedclothes and mattresses are removed and cleaned or, if straw mattresses are in use, they are destroyed and replaced by new ones, and the ship is thoroughly cleaned and disinfected.

The United States Immigration Service is very extensive and very well organized. It covers more than 50 ports or places of entry, including points on the Canadian and Mexican borders. The business is conducted under the Federal laws, and the regulations issued by the commissioner general, approved by the Secretary of Commerce and Labor. The larger and more important stations are under the immediate control of commissioners. At the smaller or substations the business is conducted by an inspector in charge. At the port of New York there is one commissioner and one assistant commissioner

(at present William Williams and Byron H. Uhl, respectively), and under them about 500 other officials, incluidng superintendent, chief clerk, treasurer, law clerk, civil engineer, chiefs of divisions, inspectors, interpreters, clerks and stenographers, mechanical engineers, matrons, watchmen, and laborers. The boards of special inquiry, varying in number from a minimum of four to a maximum of eight, are composed each of three inspectors specially detailed for the purpose.

PHYSICAL AND MENTAL EXAMINATION UNDER IMMIGRATION LAWS.

The United States Public-Health Service is charged under the law with the physical and mental examination of all arriving aliens. The medical officers engaged in this work are detailed by the Surgeon General, by approval of the Secretary of the Treasury. The medical officers thus detailed are responsible for the efficiency of the medical examination. At the port of New York their duties are performed under the direct supervision of a surgeon of the service designated as chief medical officer. The examination is conducted in conjunction with the inspection instituted by the Commissioner of Immigration and in accordance with the requirements embodied in the official book of instructions, by direction of the Surgeon General, and approved by the Secretary of the Treasury. And, generally speaking, the work goes on as smoothly and as harmoniously as if all were wholly under control of one and the same department. At all events, such has been our experience for a number of years.

At many of the smaller stations, of course, there is only one doctor on regular duty, while at New York the number varies from 18 to 25 medical officers, 2 pharmacists, and upward of a hundred attendants, including clerks, stenographers, nurses, and orderlies.

The medical office in connection with the Immigration Service at the port of New York is composed of four branches:

(1) Line of primary inspection of all passengers arriving at Ellis Island; examination of all immigrants turned aside from the line for further or secondary examination; the issuing of medical certificates of physical or mental disease or defect for the information of the immigration officers and boards of special inquiry; the making of all records and the thousand and one memoranda pertaining to immigrants turned aside from the line for special examination or sent to hospital for further observation or treatment.

(2) Care and treatment of patients admitted to immigrant hospital, the supervision of the duties of the hospital employees, and the care of the hospital buildings and grounds.

(3) Care and treatment of patients admitted to Immigrant Contagious Disease Hospital; the supervision of the duties of the hospital employees and the care of the hospital buildings and grounds.

Seven thousand two hundred and forty-six patients, including 529 accompanying persons, were admitted to these hospitals during the year ended June 30.

(4) The examination of cabin passengers on incoming vessels in the bay (if necessary, sending them to Ellis Island for further examination or hospital treatment), and the examination of any steerage passengers requiring immediate attention or ambulance transportation to hospital direct from ship.

The medical examination of incoming travelers at New York, as already indicated, begins at the entrance of the harbor—at the State quarantine—and is made by State officials, under the immediate supervision of the health officer of the port. No passenger is now detained there, however, unless he presents signs or symptoms, has been exposed to or is suffering from a maritime quarantinable disease, namely, smallpox, yellow fever, cholera, typhus fever, leprosy, or plague.

Immediately upon the completion of the State inspection, or release of the ship at quarantine, the vessel is boarded by inspectors of the Immigration Service and the medical officers of the Public Health Service, who examine the cabin passengers and complete their work by the time the ship arrives at her dock in the city, Jersey City, Hoboken, or Brooklyn. Any cabin passenger found to be afflicted with physical or mental disability is immediately certified by the medical officers for the information of the immigrant inspector, except such as may be detained on board, or sent to the medical office or hospital at Ellis Island for further observation or treatment. The medical officer also examines any sick persons under treatment in the ship's hospital, and any aliens among them are immediately transferred to the immigrant hospital, or, in certain exceptional cases, to the nearest hospital in the city. Formerly all arriving aliens suffering from acute contagious disease were cared for in the New York City health department hospitals under contract, except for one or two years, when care for such patients was furnished at the State quarantine hospital. It is not a very uncommon occurrence for a ship to arrive with 20 cases of measles on board and occasionally with 40 or more. There is also a considerable number whose symptoms develop only after arrival at Ellis Island or, for other reasons, after being detained in the main building there, and who are then admitted to the Contagious Disease Hospital.

Cabin passengers entitled to land are released at the city dock, but all steerage passengers are carefully grouped in accordance with the list or manifest sheets and numbers, and are then transferred by means of barges to the immigration landing place, main building, Ellis Island, where immediately after arrival they are inspected by medical officers. The present arrangement consists of three lines for primary medical inspection, with two and sometimes three medical officers and necessary attendants on each line. The first doctor takes his place about 15 feet up the line and examines the immigrants as they come along single file. If the first doctor observes any physical

or mental defect or suspicious symptom, he indicates the same by a chalk mark placed on the immigrant's clothing, and then allows him to proceed in file to the doctor at the end of the line. The second doctor repeats or supplements the examination of the first, everts all eyelids, and turns aside for further or special examination (in the rooms provided for the purpose) each and every immigrant, including those marked by the first doctor, presenting signs or symptoms of physical or mental disease, defect, or abnormal condition of any kind.

Those who are passed on the primary inspection line pass immediately, by means of a convenient stairway, to the registry division, on the floor above, where the officers of the Immigration Service begin their work. The aliens turned aside from the line for secondary medical examination are detained by the doctors only long enough to complete their examination, or, except for those sent to hospital for further observation or treatment, until the necessary certificate, memoranda, etc., are made for the information of the immigrant inspectors or Boards of Special Inquiry.

For the purpose of carrying out the provisions of the immigration law, and in accordance with the Book of Instructions, issued by the Surgeon General for the guidance of medical officers, the physically and mentally diseased and defective aliens are conveniently divided into three general classes:

(A–1) Aliens whose exclusion is mandatory under the law—idiots, imbeciles, the feeble-minded, epileptics, and insane persons, persons afflicted with tuberculosis; also (A–2) persons afflicted with a loathsome contagious disease, (for example, favus, ringworm of scalp, sycosis barbæ, actinomycosis, blastomycosis, frambesia, leprosy, venereal diseases); persons afflicted with a dangerous contagious disease (for example, trachoma, filiariasis, uncinariasis, amebic infection, endemic hematuria).

(B) Diseases or defects that, in the opinion of the medical examiner, will materially impair a person's capacity for self-maintenance, or, as the certificate is usually worded, which affects ability to earn a living, or (in the case of children) which will affect ability to earn a living and hence "be regarded as conclusive or contributory evidence to justify the exclusion by the proper immigration officers of the person in question as an alien likely to become a public charge."

(C) Diseased or defective conditions of less degree than those which, in the opinion of the medical examiner, affect ability to earn a living.

Among the diseases classified in the subdivision as dangerous contagious, trachoma is given first place, not only because of its serious consequence to the immediate sufferer, and its wide dissemination in countries where it has been introduced, but also because of its chronic, inveterate character, so difficult to cure, and in many cases rebellious to all treatment. These also, among other reasons, were given as the basis upon which medical and opthalmological associations of this country, some 15 years ago, passed resolutions urging the Govern-

ment to place trachoma under the category of the dangerous contagious diseases and thus effect the exclusion or prevent the further introduction into the United States of a communicable disease, and of a class of persons from whom so large a proportion of the inmates of institutions for the blind and recipients of public dispensary charity are recruited.

Eighteen ninety seven (1897) was the first year in which trachoma was declared an excludable disease, and since then thousands of aliens have been certified for this disease and returned (deported) to the country whence they came. There are not now so many cases of the most advanced type of trachoma observed among arriving aliens as formerly. This is due, not only to the fact that a considerable number of hundred-dollar fines have been imposed upon steamship companies for bringing in such cases, but because of the effort the steamship companies themselves are making to prevent the embarkation of would-be immigrants suffering from disease of the eyes. This is especially the case at Italian ports where medical officers of the Public Health Service are on duty in connection with the Federal quarantine service, and who incidentally, and at the request of the steamship companies, aid in the examination of emigrants, albeit in an advisory capacity only, but with the result that hundreds are rejected or refused transportation to the United States. Well-equipped emigrant detention and inspection stations are maintained, however, by the steamship companies at other ports of embarkation, notably at Hamburg, Bremen, Rotterdam, Antwerp, Liverpool, and also at different points on the German-Russian frontier, where emigrants are inspected by physicians employed by the companies, or by the Government authorities. For many years, as indicated, trachoma was regarded by many of our professional brethren as one of the most important affections included in the excludable list, and while it is still so considered by the Government, some doctors in private practice now seem to look upon it as a bugbear, rather than a seriously or dangerously contagious disease. But this may be due to the fact, as already intimated, that there is not now so much of the virulent type of the disease in evidence as there once was, because of the thousands rejected and kept out of the country during the past 15 years.

Of course, the vast majority of arriving aliens found to be afflicted with physical ailments or abnormalities naturally fall under class B, 10,752 of this class being certified for such afflictions during the year ended June 30, 1912. But, although so many were certified for disease or defect which, in the opinion of the medical officer, affected their ability to earn a living, it does not follow that all, or even a majority, of them were deported, for the reason that in these cases the medical certificate is not mandatory, but is regarded, under the interpretation of the law, or by the regulations of the Immigration

Service, as contributory evidence only, or as one only of several factors constituting a condition which renders an alien "likely to become a public charge." For example, of 941 aliens certified last year for lack of physical development, 479 were landed; certain favorable factors in or about many of these cases outweighing that of the medical certificate to such an extent that, in the judgment of the board of special inquiry, the individuals affected were not likely to become public charges.

If, on the other hand, an alien is rejected by the board on the ground that he is likely to become a public charge, he has the right of appeal to the department in Washington, through the commissioner of immigration; and friends or relatives may also offer guaranty or bond against the likelihood of the alien becoming a public charge.

If, as some one has said, the way to restrict undesirable immigration is to restrict it, it is safe to say that the best way to effect the exclusion or deportation of a very undesirable class of immigrants is to enlarge the list of physically and mentally defective aliens constituting the mandatorially excludable class. This can be done, of course, by act of Congress.

Prior to the enactment of the law of 1907, although a considerable number of insane persons, epileptics, and imbeciles were certified and deported, persons found to be and certified as feeble-minded to an extent affecting their ability to earn a living were seldom deported, for the reason that the law of 1903 ended at imbecile and said nothing about feeble-minded; whereas, any one of the beforementioned affections was by the law itself declared positively excludable.

During the fiscal years 1904 and 1905 more than 75 per cent of the certified feeble-minded aliens were landed and less than 25 per cent deported. But witness the change. In 1906, 78 per cent were deported, and 20 per cent were landed. This remarkable change for the better was brought about largely in deference to public opinion, as it was reflected in the discussion of the immigration bill then pending in Congress, and in anticipation, as it were, of its enactment into law, which occurred the next year. By this act, as already intimated, the feeble-minded were added to the class of mentally defective aliens which the law expressly declares shall be excluded from admission into the United States. And because of the heavy and increasing immigration, and the quality of much of it, the medical officers on Ellis Island duty were increased in number, the facilities for performing their duty improved, and, as a consequence, a larger percentage than before of all kinds of physically or mentally diseased or defective aliens, including the insane and feeble-minded, began to be detected and certified.

The following year 97 per cent of the certified feeble-minded were deported, and this average ratio is being maintained. The falling short of the hundred per cent of deportations of aliens thus certified is in some cases due to questions of citizenship, or to other questions presented through the agency of a lawyer, or the advocacy of an outside physician, who, in deference to well-to-do or influential friends or relatives of the alien, or because of their importunities brought to bear upon the head of the department, is given respectful hearing; or, in other cases, to a disposition on the part of the authorities not to unmercifully separate children from their parents; or, as the head of the department is said recently to have declared in the exercise of the discretion imposed upon him, that he "believed in tempering justice with mercy."

A curious anomaly in the law relating to this class of aliens is that whereas, under certain conditions hereinbefore referred to, a fine of a hundred dollars in each case may be imposed upon the steamship company for bringing to the United States an idiot, epileptic, or imbecile, the law is silent in this respect with regard to feeble-minded or insane persons. No hundred-dollar fine is demanded of the steamship companies in these cases, the only penalties being a possible $10 fine for false or neglectful manifestation and the expense of return transportation for the aliens to the foreign port from which they came. It is not easy to understand just why the act of Congress made this discrimination in the two most troublesome affections we have to contend with at Ellis Island, except it be solely because they are the most troublesome. This characterization is not intended to apply to the obvious cases of insanity or feeble-mindedness, the types or advanced degrees of insanity or mental defect most frequently met with in public institutions, but to the more numerous, ill-defined, border-line cases often so difficult to detect on primary inspection, and not always so easy of solution on secondary or special examination. And these are the subjects which, when certified by the Government medical officers, are apt to attract and sometimes bring grist to the mill of the outside doctor advocate, although these aliens are not as a rule the sons of rich parents trying to avoid or to be released from the asylum. Their friends are eager only to see them landed and not deported, and to this end an appeal as to diagnosis by or through the doctor advocate seems to offer the best means of securing a stay of deportation if not always a sympathetic consideration by the powers that be.

These remarks are not made with any intention other than to acquaint our brethren with the fact that at Ellis Island we have some professional obstacles to contend with diametrically opposite to the reflections sometimes cast upon us by over-enthusiastic critics for not accomplishing all the good they think we ought to accom-

plish even under the limitations of existing law in our efforts to protect the country at large, and New York State in particular, against the burdensome insane or mentally defective aliens.

From the foregoing outline of the Federal statutes governing immigration it will be seen that what Congress had in mind in the various acts referred to was not only to lessen the hardships and discomforts of immigrant transportation by sea and to encourage the coming of desirable aliens, but also to impose reasonable restrictions at ports of embarkation against the introduction into this country of paupers, lunatics, and other undesirables. Experience proves, however, that in order to effect the object of legislation to this end a more thorough and systematic examination than at present obtains should be provided for all would-be immigrants at ports of foreign embarkation, either at their home or at the office of the United States consul nearest their home, thus avoiding exclusion and heartrending disappointment at ports of arrival in the United States after the long and dreary voyage across the ocean. But if that can not be done (and it is proper to say that strong arguments have been expressed against it) then the next best thing to do would be to detail a larger additional number of medical officers at ports of arrival, especially at New York, and for their assistance furnish all the interpreters necessary for the 30 or more languages and dialects we have to contend with in the difficult work of detecting or determining the presence or the absence of the ill-defined or only slightly developed mental defects which in their later development or transmission are fraught with so much danger to future generations and to the body politic, to say nothing of the ordinary economical side of the question of State burden.

As already indicated, this implies a larger medical force, an increase in the number of qualified doctors. And if the doctors are qualified as psychiatrists or desire to become specially qualified as clinical psychiatrists, neurologists, opthalmologists, laryngologists, dermatologists, hygienists, and heart and lung specialists, or specialists in any or all of the branches into which the practice of medicine may be divided, so much the better, more especially if in this fine field of opportunity for professional or scientific advancement they appreciate the importance of interdependence and are mindful of the fact that a man must be a doctor well grounded in the fundamentals of medical science before he can be a specialist; that he must know the normal before he can have a proper conception or a practical understanding of the abnormal.

The importance of knowing the normal applies to any physical or mental examination work, even where all the people presented for examination are of the same race or nationality; whose manner,

behavior, or general characteristics are essentially the same. But at Ellis Island we meet with many different races or peoples, and a proper understanding on the part of the medical examiner of the peculiarities of each is very important. The normal racial characteristics of the one might be anything but normal if observed in the other. The emotional gesticulations of the southern Italian might not in the least militate against his passing O. K. on the line of primary inspection if otherwise admissible, but the northern European—the Dutchman, for example—presenting himself in the same manner would be turned aside from the line by the experienced medical officer for secondary or special examination. The differences between some other races are less striking. But all are important in connection with the line work, where the apparently healthy must be separated from the diseased or defective. The action of the medical examiner in passing O. K. the larger number on primary inspection involves as high a degree of efficiency as the detection of and turning aside from the line of the smaller percentage for secondary examination in whom some sign or symptom is manifest to the eye of the examiner indicating the existence of physical or mental disease or defect. At Ellis Island, under existing conditions, the examination of the large majority must be practically completed on the primary inspection line or in the adjoining medical-examination rooms and on the day of arrival. Of course, many (over 7,000 annually) are admitted to and detained in hospital for further observation or care and treatment, but the number thus detained is small in comparison with the total number of arrivals. With ample accommodations many more might be advantageously detained for a longer period of observation; hence the necessity for additional space in the main building for more interpreters and for a larger force of medical officers.

Under existing law the physical and mental examination of arriving aliens is made by medical officers of the Public Health Service, detailed by the Surgeon General, on approval of the Secretary of the Treasury. But for the interpreters and for the facilities for conducting this examination the medical office is dependent upon the commissioner of immigration, and he in turn upon the commissioner general or the Secretary of the Department of Commerce and Labor, all hinging, however, upon the necessary congressional appropriation.

To appreciate what has already been accomplished in this line one needs only to compare Ellis Island, and even the medical office, as it is to-day with what it was only a few years ago. But there is now a crying need for additional facilities, and hence for the additional appropriation so strenuously urged by Commissioner Williams.

If 20 lines and as many immigrant inspectors and interpreters are necessary for the registry floor, if rooms and interpreters and stenog-

raphers and typewriters are necessary for each of the several boards of special inquiry, if the detection and certification of the physically and metally defective are of as much importance as the exclusion of a contract laborer or otherwise inadmissible alien, it stands to reason that similar accommodations and double the number of doctors should be provided for the medical end of the work, for by such means only will it be possible to accomplish best results, and also to apply or try out the newer methods (à la Fernald, Binet-Simon, Goddard) for the detection of the moron or the border-line cases of mental defectives, or to measure the degree or relative degree of abnormality in any considerable number of arriving aliens. Finally, in the question of deportation, no limit as to length of residence in this country should apply to any physically or mentally defective or otherwise excludable alien, for when all necessary facilities and safeguards shall have been furnished and applied there will still be room for improvement in the quality of a certain number, though relatively small proportion, of aliens who, if brought here, must be admitted under the law unless general restriction be placed upon all foreign immigration.

[1] Marine hygiene on board passenger ships, by A. N. Bell, M. D. Annual meeting A. P. H. A., Boston, 1876.

[2] Hygiene of Emigrant Ships, by T. J. Turner, M. D., etc., United States Navy, Annual meeting A. P. H. A., New Orleans, 1880.

IMMIGRATION WITH REFERENCE TO ITS CAUSES AND ITS EFFECTS UPON THE GROWTH AND ETHNICAL CHARACTER OF THE POPULATION OF THE UNITED STATES.

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The early settlement of all the 13 American Colonies was the result of either English or Dutch commercial enterprise. The Englishmen or Dutchmen who held concessions of one kind or another in the New World sought to develop them to their own financial profit. They stood ready to take advantage of the unrest of those people whose position in Europe was from time to time rendered uncomfortable by reason of their political partisanship or religious tenets. But from the first the possibilities of emigration have appealed only intermittently to people of that sort. The opportunities of the New World have appealed far more constantly to those who have been restless from purely economic causes; to the land-hungry younger sons of the European yeomanry, the young professional man, the merchant, the trader, the mechanic, the laborer, the adventurer, and the scamp. Then, too, from the first, as now, immigration has represented not only the voluntary act of an individual but the

result of the successful commercial exploitation of those who would have been incapable of reaching this country on their own initiative.

The population of the new Nation at the time of the first census in 1790 was found to be nearly 4,000,000, about equally divided between the States north and south of Maryland. Of this population nearly 700,000, or over one-sixth of all, were negroes held in slavery both in the South and the North. No census had previously been attempted in any of the colonies. No effort was made to keep records of foreign passenger arrivals until 1820, and the foreign-born inhabitants of the country were not made the subject of separate census enumeration until 1850. Throughout the earlier history of the country we are, therefore, without definite statistical data to assist us in estimating the part played by natural increase and by immigration in determining the growth of population or its ethnical composition. Moreover, it takes little critical examination to show that some of the estimates that pass current with respect to these matters rest on very untrustworthy data. It seems safe to say, however, that by 1730 the population of the Colonies was approaching 600,000. By this time also the political-religious disturbances in Europe, which had been prominent factors in inducing the earlier colonization movements, were losing their force, and immigration had already begun to partake more of the character of a response to a demand for labor in a new nation. During the 100 years preceding 1730 there had been established here every distinctive racial, national, or social element that, until late in the nineteenth century, appeared in appreciable numbers in immigration to this country. So, also, for the greater part of the hundred years after 1730 immigration was a relatively unimportant factor in comparison with natural increase in determining growth in population.

Spaniards, Portuguese, Italians, Greeks, Scandinavians, and stragglers from various other European countries appeared in the American colonies at a very early date. So, also, to a limited extent, did European Jews. But, as a basis for considering the ethnical composition of the white population of this country in 1790, it is practically only necessary to take into account three migratory movements which had set in from Continental Europe, the Dutch, the Huguenot French, and the German, and add to them the larger and more promiscuous influx which had constantly been coming from the British Isles.

The first of these continental migrations to be mentioned is the Dutch, who came out to their American colonies, continued to come after these colonies passed into the hands of the English, and have, with periodic fluctuations in numbers, been coming to this country ever since. Incidentally, also, the Dutch planted a small successful colony of Swedes in the Delaware region in about 1638, but this

project did not give rise to any further Scandinavian immigration, and the colony owes its prominence in early colonial history to reasons other than the insignificant part it played in the growth of the population of the region where these Swedish colonists settled.

It has been variously estimated that, during the three years following the revocation of the edict of Nantes, in 1685, France lost from 100,000 to 1,000,000 inhabitants. Large numbers went to Holland and to England, from both of which countries a certain proportion subsequently made their way to the American colonies, scattering themselves from Maine to South Carolina. The exodus following the revocation of the edict of Nantes, however, only marked the culmination of a French immigration to the American colonies which had already begun. French Huguenots had been quietly settling in both New York and New England for many years, and before the movement subsided it had brought hither French immigrants differing widely in social status and in locality of origin. How many of these French Huguenots came to the colonies first and last we do not know. They figured most conspicuously in the less-populous colonies of the South, but it seems to me very improbable that the aggregate of this immigration ever reached 50,000. Its subsequent influence upon American history was due to its character rather than to its magnitude. This Huguenot immigration was composed in the main of substantial people of high personal character, who represented the most advanced stage of industrial development to be found in Europe at that time. Among the immigrants were men of exceptional ability belonging to families long prominent in the public affairs of France. It is to these facts, rather than to the amount of this immigration, that the important influence of the French Huguenot element in subsequent American history is to be ascribed.

About 1680, or a little before the exodus of the Huguenots from France, German-speaking immigrants from that part of central Europe known as the Palatinate began to appear in connection with the British immigration and the migration of the American colonial population itself which was setting toward Pennsylvania at that time. Early in the next century impoverished German fugitives from the Palatinate to England began to be exploited commercially as a labor supply and as potential colonists, and were dumped into Pennsylvania in large numbers. They were not adapted to succeed in the conditions they encountered, and became such a burden on the young colony that an effort was made to check their coming. Somewhat later, however, a German immigration of a distinctly different character, including a large proportion of substantial, self-reliant, and educated people, made its appearance, following chiefly the track of earlier German-speaking immigrants into Pennsylvania, whence

it spread out somewhat toward the south. This German immigration appears to have been recruited largely, but not entirely, from southern Germany and the Rhine provinces. With it came also some Swiss and Bohemians, although the so-called Moravians who were associated in this movement are to be ethnically regarded as German adherents to the Moravian Protestant sect rather than Slavs. The German immigration to the American colonies had passed its maximum by 1750, and appears to have dwindled to insignificant proportions by the time of the Revolution. There seems, however, to be no good ground for disputing the estimate that one-third of the 435,000 inhabitants of Pennsylvania in 1790 were Germans.

In considering the part played by immigration from the British Isles during the colonial period one can not fail to be impressed with latter-day efforts to emphasize the importance, in the formative stage of the Nation, of immigrants from Ireland. We see constantly increasing the number of men prominent in our early national history whom we are told should be credited to Ireland, and we are led to infer that we must correspondingly increase our estimates of early Irish immigration as well. In investigating the evidence on which it is asserted that such men are to be regarded as Irish it will often be found that the claim rests merely on the fact that they have names borne by some people who may be found living in Ireland. Beddoe has shown that 58 per cent of Irish army recruits have family names common to both Great Britain and Ireland, and while every American may not be able to prove that some paternal ancestor of his did not once live in Ireland, many of them are able to do so, and the whole credibility of these recent Irish-American historians is weakened by the fact that they credit to Ireland men whose families it can be easily shown never saw Ireland, and claim as Irish settlements towns in this country which had been in existence 150 years before they ever saw anything more than a few straggling Irish immigrants.

That there was an immigration from Ireland to the colonies, and that it made its appearance at a very early date in practically all the colonies, is abundantly proved by contemporaneous colonial records. It represented people who had emigrated from Great Britain to Ireland anywhere from a few years to a few generations before, both with and without admixture with the preexisting Irish population; it also represented older Irish stock coming here, not only directly from Ireland, but after temporary domicile in England. It varied greatly in quality, contributing men who were prominent constructive forces in colonial development, and also containing an element which continually aroused justifiable apprehension. As to the aggregate amount of this immigration, the evidence is so unsatisfactory that it is useless to speculate, but it can be safely affirmed that Irish immigration of the character referred to did not become an important

factor in the growth of the population of this country until the later migration of Irish which began early in the nineteenth century.

There was, however, an important migration from Ireland in colonial times, the so-called Scotch-Irish, which should be separately considered, because, as has been said with some reason, it was neither Irish nor Scotch. It consisted of lowland Scotch and English people whose ancestors had migrated to northern Ireland in the latter part of the seventeenth century. The region whence these people moved over to Ireland was the part of Great Britain which most showed the effect of the early Danish and Norwegian invasions, and, unless the conclusions of modern anthropology be absolutely worthless, these Scotch-Irish immigrants were more Germanic in blood than those from any other part of the British Isles, except possibly the east coast of England. They began coming about 1720, and for 50 years continued to form a conspicuous element in British emigration to the American colonies. They followed the trend of the native American migration of the time into Pennsylvania and the South, but also settled in New England and New York. How many came before this movement abated we do not know. But while its aggregate could not have been anywhere near 500,000, as has been estimated, it was in numbers, as well as in its average standard of thrift and intelligence and in its subsequent influence on national life, one of the most important immigrations that appeared during colonial times.

Neither Scotland nor Wales has ever figured conspicuously in immigration to this country. Scotch emigration has tended rather toward Canada, but Scotch were among the earliest settlers in New England as well as in the South, and Highlanders as well as Lowlanders continued to come during the colonial period as they have been doing steadily ever since, reaching us via Canada and directly from Scotland.

However much we may strive to emphasize the importance of the colonial immigrations I have mentioned, we are constantly confronted with evidence that in 1790 the population of the whole country, from Maine to Georgia, must have been predominantly English. The dominance of English influences at that time can of course be hardly disputed, but take Rand & McNally's Atlas and run over the long list of place names in the State of Pennsylvania, which some historians would make us believe was settled by the Germans and the Scotch-Irish. That in this list there are many names which clearly bespeak the presence of German and Scotch-Irish pioneers only serves to accentuate the fact that the vast majority of place names in this State indicate the early presence of people of English antecedents. The English element in the population of this country is not to be ascribed to an early English Puritan colony in New England and an

English Cavalier colony in the South, as might be inferred from some of our school histories. When the Puritans were founding their much-advertised colony on Massachusetts Bay, other English not in sympathy with the Puritans at all were settling other parts of New England, and at the same time English Puritans and other English who could not be regarded as Cavaliers were beginning to settle farther south. From early colonial times down to the present a stream of English immigration has been steadily pouring into this country. The magnitude of this immigration is not realized, because English immigrants become so quickly unrecognizable, but in its aggregate it has been enormous. Take it even from 1820 down to the present time, and our English immigration, if that coming via Canada be taken into account, has practically equaled our Irish immigration and has been exceeded in numbers only by the German.

In the 100 years from 1790 to 1890 the white population of the United States had grown from about 3,300,000 to 55,000,000, and the 700,000 negroes had increased to nearly 9,000,000. For 70 years of this period, or after 1820, we have available more or less incomplete records of foreign passenger arrivals, erroneously called "statistics of immigration." If the gain in the foreign-born population for any decade, as shown by the census reports, be compared with these so-called immigration statistics for the intervening 10 years, it will be seen that the latter furnish about the same sort of basis from which to estimate growth of population of the country as the annual sale of ferry tickets in New York might offer for estimating the growth in population of that city. Using these statistics of alien passenger arrivals in conjunction with the census reports, we can, however, arrive at certain general conclusions as to the effects of immigration upon the population of the country during the last 60 years at least.

Since 1870, when the parentage of the population was first made the subject of census enumeration, about 50 per cent of the white population have been either foreign born (including Canadians) or persons of foreign parentage. It may be noted in this connection that of such persons of foreign birth or parentage in the country in 1900 about 10 per cent were natives of Canada or their children. One-fifth of the increase in the foreign-born population between 1890 and 1900 was due to the immigration of such natives of Canada who for many years have constituted 10 per cent of our foreign-born population and, except to a very limited extent, have never been included in official immigration statistics. The figures for 1910 are not available. In considering the remoter effects of immigration upon the ethnical composition of the population it should be remembered also that a considerable but unknown proportion of immigrants, varying with different nationalities, never leave any progeny behind them. So, too, some very suggestive but not absolutely con-

clusive investigations indicate that while the average number of children to an immigrant woman exceeds the average to the native-born American woman, the number of children to the native-born woman of foreign parentage is markedly less than the average for the American-born woman of older stock.

About 1860 Scandinavian immigrants first began to appear in noteworthy numbers, and immigration from this source rapidly attained important proportions; but, with this exception, the only foreign people who to any appreciable extent contributed to the growth of the population of the country from 1790 until after 1880 belonged to exactly the same nationalities and races which had gone to form the population of the Colonies at the time of the Revolution. Within the last 25 years these nationalities, which had predominated in immigration from the earliest settlement of the country, have been steadily supplanted by a new immigration different, not merely in racial complexion but in motive power, from anything that the country had hitherto known. Of this new immigration I will speak later. The older type of immigration has, however, by no means ceased to come, and, so far as the ethnical composition of nine-tenths of the white population of the country to-day is concerned, we still need practically only to consider the same racial elements which went to make up the population of the country in 1790. The relative proportion of these racial elements in the population has, however, been changed. In immigration since that date the Germans stand far in the lead. There have been about two-thirds as many Irish as Germans; probably about the same number of English as Irish, if immigration of both these national stocks from and via Canada be taken into account; about one-fifth as many Scandinavians as Germans, and a total from Scotland, France, Switzerland, Holland, and Belgium about equal to the number of Scandinavians.

This country is and always has been remarkable for the mobility of its population. In 1900, 21 per cent of the inhabitants of the United States were living in States other than those in which they were born. This movement of our population has not only determined the distribution of immigration but has been the chief means of assimilating it as well, for immigration never leads but always follows the movement of our older population or our own capital, whether it be to the city, to the manufacturing center, or to newly developing agricultural regions. Nothing could be conceived as better calculated to break down sectional, racial, or social isolation and promote the intermarriage of people of different races or different ancestral stocks than this mobility of our population; yet available information seems to indicate that anything like a promiscuous racial admixture of even the older national elements in this country has been proceeding very slowly. Where the population is

sufficiently numerous and varied to permit of natural selection the tendency seems to be for intermarriage to confine itself to what might be termed different varieties of the same human species. This tendency is indicated by the information regarding natives of foreign parentage to be found in the national census reports.

In an effort to carry this matter a step further and to test the results of similar investigations reported by others, I have personally made an extended examination of marriage certificates filed in New York City. I selected New York not as necessarily representative of what is taking place in the country as a whole, but because I know of no other place where the population is so varied, where different ethnical elements are thrown so much together, or where barriers of language or race weaken so quickly. These marriage certificates give the names and birthplaces of the parents of both the bride and the groom. When a parent was a native I judged the national extraction from the person's full name. This investigation showed, of course, that intermarriages across distinct racial lines do take place, but that when the total marriages are considered their number is astonishingly small. Apparent instances of this sort, of marriages between persons of different foreign countries of birth or between natives and foreign born, are also markedly reduced if marriages between persons of the same language and racial extraction be excluded. The native born show a discrimination in marriage against the foreign born of the same national extraction. This is manifest even in the case of the Irish, where language does not enter as a factor, and is remarkable in view of the fact that so many foreign born come here very early in life.

Where mixed marriages have occurred in the case of foreign-born or native-born parents there seems to be a tendency for the children to marry persons of the same national extraction as one or the other of the parents. For instance, if the father of the bridegroom was German or of German extraction and his mother Irish or of Irish extraction my study led me to expect to find the bride to be of either pure Irish or pure German extraction. So, too, if a French name appeared in connection with the family of the bride there would be a fair probability that I would find one in connection with the groom's family as well. In fact, if we leave out of consideration the negro and the newer races which have appeared in immigration within the last 25 years, it may be said that we have only been stirring about on this continent, a little faster and in a somewhat different receptacle, the same racial ingredients that have been moving about in northern and western Europe since the fall of Rome. Back of it, too, we find the same motive power, for, unlike Central and South America, the vast bulk of the people who have

settled and developed this country have been tinged at least with the same restless Germanic blood.

There has of course always been, in European migration to this country, a considerable element of which this can not be said. So, also, there have been many factors which have gone to determine our history, which could not by any stretch of the imagination be attributed to Germanic influences. But practically pure Germanic blood constitutes by so far the largest single racial ingredient which has been poured into this country down to the present, that it becomes a matter of interest to try to see to what extent previous Germanic admixture in Europe may have entered into the rest of our immigration. This we are now able to do with a reasonable degree of assurance, since progress in anthropology has dispelled the time-honored delusion that language is an indication of racial extraction.

Our immigration from Belgium and France has represented varying degrees of admixture of Germanic with the older brachycephalic Alpine race. Probably our old Huguenot immigrants were chiefly of this Alpine stock. From western and southern Germany it would seem that our immigrants, like those of eastern France, represented varying degrees of admixture of the Germanic and the Alpine races. Also, from some parts of Germany our immigrants have had a pronounced Slavic strain. But it is safe to say that most of our immigrants from Germany, as well as those from Sweden, Denmark, Norway, and Holland, have been of nearly pure Germanic stock, although Holland itself is not wholly Germanic, and in both Denmark and Norway there are distinct traces of the Alpine race.

Coming to the British Isles, we find that we are dealing with the representatives of several prehistoric races, neither Germanic nor Alpine, which have been partly pushed aside by and partly mixed with various Germanic stocks brought in by successive Germanic invasions, dating back to pre-Roman times. In the light of more recent anthropological research, it would appear that, in England, these Germanic invaders never supplanted the old British people to the extent that was formerly supposed, and that, while the east of England is markedly Germanic, inland and westward Germanic physical characteristics tend to become associated with the landowning ruling class. In taking this evidence into account, it does not seem improbable that our enormous immigration from Anglo-Saxon England may have been more prehistoric British than Germanic in its ethnical composition.

In the lowlands of Scotland, and farther north, where chiefly the Danish and the Norwegian migrations poured in, all around the coast, and in the Shetland and Hebrides Islands; in fact, everywhere, except in the Highlands of Scotland, the population, regardless of language, is predominantly Germanic, however it may have hap-

pened. What became of the Scots who are supposed to have gone over from Ireland to Scotland, we may not be able to say, but, unless anthropology is absolutely worthless, our famous Scotch-Irish immigrants, whose grandfathers went over to Ireland from the Lowlands of Scotland, were far more Germanic than most of our immigration from England itself.

If natives of Ireland have any common temperamental characteristics, it must be due to some other cause than homogeneity of race. In Ireland, as in England, from the ninth century, by colonization by Norwegians and Danes, through Norman times, and by later migrations from Great Britain itself, the prehistoric races have been crowded by or mingled with invaders more or less Germanic in blood. As in England, the physical characteristics which these alien invaders have left in the population are more apparent in certain districts and in certain social classes, but in considering the sources of Germanic blood in our own population, our immigration from Ireland must not be left out of account.

But while different races or nationalities may be regarded as possessing certain qualities or characteristics which have determined the part they have played in the world's history, the character and the possibilities of the individual immigrant himself are of more practical interest to the country than the general attributes of the nationality or race to which he may happen to belong. Except for our negroes, all our immigrants who have come to this country in appreciable numbers up to within 25 years ago have been drawn from the races which have made the nations of northwestern Europe represent the culmination of human advancement. These races, as a whole, have possessed qualities which have made their nations stand where they do, but none of them has ever been without elements of population which have failed to contribute to national development, and development and progress in itself have always been accompanied by the formation of a greater or less amount of social detritus really pathological in character.

In our immigration there is, and always was, to be found individuals representing all social distinctions and every conceivable motive that could induce or compel a man to leave his native land, but our immigration has never drawn proportionally from all the different social elements of the population of any foreign nation. Only at a few brief epochs in our history has our immigration contained a conspicuous proportion of people who have been active constructive forces in either the industrial or political life of the countries they have left. Fortunately, however, this country has thus far been able to offer opportunities which have appealed pretty constantly to the decent, energetic, normal, self-reliant European middle class, and to many lower in the social scale, who have proved poten-

tially superior to the social status they had previously been occupying abroad.

From the first the most potent single factor in determining the character and proportions of our immigration has been our demand for unskilled labor. From the first also this country has been burdened with a certain proportion of the social detritus of Europe. This type appears in the police records of the earliest settlements—records that speak much for the general moral standard of the early colonies, in that they show that moral depravity was obnoxious to public sentiment and that laws relating thereto were enforced. Degenerate humanity has been coming here ever since, often under the guise of political and religious refugees, the downtrodden and oppressed, blaming others, as this type always does, for the conditions for which its own defectiveness is actually responsible. Such social detritus has come, and is still coming, in response to a demand for cheap unskilled labor, a demand which neither this type nor its more degenerate progeny has the mental and physical capacity to fill. The demand for this cheaper class of labor has been insatiable. Efforts to supply it are accountable for the presence in this country of over 9,000,000 Africans. The crude method of collecting negro slaves has gone out of date.

Through a process of gradual business development, emigration has been made available as a profitable business proposition to people who, by reason of poverty or lack of individual initiative, would otherwise be just as incapable of coming to this country as were African negroes in the seventeenth century. Such people need not, of course, be inherently incapable of becoming desirable acquisitions to our population, but the methods which make their coming possible certainly tend to favor the influx of backward and defective humanity. In fact, the chief practical interest that immigration possesses is due to the character of the elements which have come here as an unskilled labor supply, and, in considering the effects of the immigration of any particular epoch, we have also to consider the prevalent commercial devices for filling the demand for labor.

From early colonial times, two methods of supplying the demand for labor were in vogue, both involving a legal recognition of bondage. The one was the importation and sale of negro slaves, and the other a system of bringing in white Europeans, "redemptioners," as they were called, and selling their services for a stipulated period in payment for their passage. Some of these redemptioners may have been estimable people, but contemporaneous testimony is to the effect that, as a rule, they were about what might have been expected. From the earliest times the labor demand also offered an excuse for assisting the migration to the Colonies of paupers and criminals. It is estimated that during the eighteenth century, before the Revolu-

tionary War, 50,000 convicted criminals were deported to the Colonies, and, while some may not have been convicted for what would be regarded as criminal offenses to-day, these figures probably do not adequately represent the criminal element that actually came.

From time to time immigration of the character just described gave rise to such serious apprehension that various Colonies enacted legislation designed to check it, but those interested in the traffic were always able to have such legislation set aside by the home Government. Negro slavery, at one time universal in the Colonies, had, by the end of the Revolutionary War, practically died out in the North, as it had proved unprofitable under the conditions prevailing there; and the sentiment regarding it in the South at that time is well shown by the fact that, when the Constitution was adopted, even those localities in the South where negro labor was indispensable were willing to agree to the prohibition of further negro importations after 1809. The sentiment against the importation of white redemptioners also made itself so strongly felt that the practice of bringing in immigrants and openly auctioning them off at the wharf on arrival, to the highest bidder, had ceased by 1820. The "redemptioner" idea, however, still survives and, in a modernized form, makes possible a large proportion of our immigration of to-day. Negro slavery has gone out of vogue, but under more modern methods Massachusetts is to-day still importing negro servants and agricultural laborers from the West Indies and Africa. So, also, with all our elaborate legislation and bureaucratic surveillance, the stream of paupers and criminals has never been stopped.

The immigration which began after the War of 1812 and reached its culmination in the fifties may be regarded as reflecting a growing appreciation of the opportunities which this country offered to various elements of the population of northwestern Europe, but the magnitude which it attained was none the less due to an awakening to the commercial profits to be derived from a traffic in emigrants and the development of new methods of exploiting it. Increasing exports, particularly of cotton, served to bring this country in more frequent communication with Europe, and immigrants offered profitable return cargoes. The old sailing ship in the forties got as much per head for carrying immigrants as the steerage rate on modern liners to-day, and prior to 1847 it was customary for the immigrants to furnish their own food as well. In fact, the profits of immigrant traffic in those days made the introduction of steamships on the North Atlantic a successful business undertaking. Conditions at that time were also particularly favorable to emigration from the parts of Europe with which our trade relations were the closest. Ireland, in 1750, had a population of about 2,000,000. Before 1840 it had increased to 8,000,000, and emigration, which to a great extent

meant assisted deportation, offered the only escape from starvation. All over central Europe protracted political turmoil and consequent economical disturbance had made the population restless and ready to accept any proposition which promised a change. For the greater portion of the period of which we are speaking the means of reaching this country was supplied by sailing ships, owned largely in this country by individuals or small partnerships lacking the resources to enter the business themselves of soliciting passenger patronage.

Therefore the same system was used in obtaining immigrant cargoes as in securing freight. The appointed agents of the ships at European ports bargained for emigrants in bulk with individuals who were led to specialize in the business of collecting emigrants because of the commissions and incidental profits to be derived from the traffic. These "emigrant agents," as they may be termed, stood practically in the same relation to the owners of vessels as shippers of any other portion of the cargo. With the institution on a ticket basis of a regular passenger service across the ocean, the emigrant agent became a general ticket agent or passage broker and his staff of field collectors subagents. With the introduction of tickets in handling the traffic came also a new device for financing, from this side, the emigration of people who might be unable to finance their own emigration, namely, the prepaid ticket. This innovation was followed by the establishment in this country of representatives or correspondents of European emigrant agents, and thus through a process of natural business development of the old emigrant agent idea Europe has been covered by collectors of emigrants; and in every immigrant colony on this continent are now to be found collectors of funds to make further immigration possible, both working as parts of the machinery of a modern international commercial institution to facilitate migration or travel. Through a similar process of business evolution the ship owners also have extended their activities by establishing branch offices of their own for the sale of tickets and by bringing independent passage brokers to accept an actual status of agents. Both shipowners and emigrant agents have encountered governmental interference. In Europe it was early found necessary to curb the activities of "emigrant agents." In this country the existence of the passage broker has been ignored and legislation concentrated on the shipowner alone.

The importance of the part which the commercial methods just outlined have played in determining both the quantity and the character of our immigration can not be overestimated. The very basis of an intelligent understanding of the kind and proportions of our more recent immigration is a clear realization of the fact that the cheaper class of steamships' patronage is still secured on the old emigrant-agent principle, through persons who stand in a

relation to the steamship companies analogous to that of Cook's agency with its tourist travel, and that, to paraphrase a familiar advertisement, one can at any time go into the ticket-office annex of a saloon in a foreign colony in this country and on payment of a fixed tariff rate arrange to have anybody in Europe collected and delivered anywhere in this country.

What the conduct of the immigrant traffic in the earlier days lacked in the way of business organization was to some extent made up by freedom from effective legal interference. An emigrant agent might bargain with European municipal authorities to clean out an almshouse or insane asylum, knowing that the shipowner could accept the inmates as a profitable cargo. A conspicuous proportion of the immigration for the 20 years preceding 1855 was of this character, or worse, and became an immediate burden on the communities where it went. Moreover, during this period immigration spread over the country a succession of serious epidemics, producing a popular fear, which still survives, of the disease-spreading possibilities of a newly arrived immigrant. A reminder of one phase particularly of the conditions of travel in old immigrant ships is found in an inscription on a stone in an old immigrant burying ground in the outskirts of Montreal, which reads: "To preserve from desecration the remains of 6,000 immigrants who died from ship fever A. D. 1847–48."

Yet in spite of the commercial greed and dishonesty, the disease, misery, degradation, and poverty which were associated with the immigration for the 30 years preceding the Civil War, it probably contained a greater proportion than ever before or since of people equipped financially and otherwise to take advantage of the opportunities which this country afforded. But the great majority of those who came at that time and who were able and willing to work found immigration a profitable venture, because of the demand for cheap unskilled labor in the industrial development of the country which was then going on. Notwithstanding the incentives to emigration which prevailed in Europe, we can seen immigration then as now fluctuating from time to time with the varying degrees of industrial activity here.

With the outbreak of the Civil War immigration nearly ceased, but before the close of the war had begun to revive, and was tending to increase annually when the industrial depression in the seventies again brought it to a stop.

In 1880 a large emigration from Europe suddenly made its appearance and, owing to a tremendous movement from Germany, quickly surpassed in numbers anything that this country had hitherto experienced. At first it came almost entirely from the countries from which immigration came from 1840 to 1860, and back of it we find in those countries a repetition of the same conditions which

acted as an incentive to emigration at the period mentioned, with a new feature—cheap ocean rates—added. The steamship companies which had displaced the owners of sailing ships in the Atlantic passenger trade were engaged with one another in a war of extermination. Rates fell as low as $10, probably more than half of which at times went to emigrant agents in commissions.

In this decade we first see immigrants from Russia, Austria-Hungary, and Italy appearing in noteworthy numbers. This was not due to a natural expansion of the small immigration that had for years been coming from the countries named. The new movement was composed in the main of an entirely different type of people from those who had hitherto come from the countries mentioned, and marks a new feature in the development of methods for supplying a certain demand for labor in this country.

The Civil War not only stopped immigration, but it either killed or crippled for life about 1,000,000 of the able-bodied male inhabitants of the country. Moreover, its demoralizing influences gave a strong impetus, at least, to the formation of the tramp habit. After the war the dearth of unskilled labor began to be acutely felt, and attention was directed toward artificial methods of increasing the supply. Still further incentive to seek new sources of supply was furnished by the strikes and labor riots which prevailed so extensively in this country in the seventies. Some experience had already been gained in methods of this sort. The Pacific coast, which had failed to receive the full benefit of the immigration prior to the war, had resorted to the importation of Chinese, but the methods which characterized this traffic and apprehension as to the effect of the immigration itself brought about legislation which finally resulted, in 1882, in altogether prohibiting the admission of Chinese laborers. Labor employers accordingly turned their attention toward Europe, and the first important results were due to a system put into successful operation by Pennsylvania mine owners and manufacturers of importing Poles and Slovaks under contracts entered into with the laborers themselves prior to arrival. The successful operation of this scheme accounts for the sudden prominence of the immigration of the Slavs from Russia and Austria-Hungary in the eighties.

The system, however, aroused the opposition of the labor organizations of the country, and legislation designed to suppress it was passed in 1885, 1887, and 1888. About the same time, Southern Italians began to be brought in for railroad-construction work, under the so-called Italian padrone system, the essential feature of which is the elimination of any knowledge on the part of the immigrant as to who his future employer will be, the immigrant coming virtually consigned to an individual whom the immigrant has selected as his financial agent and broker to dispose of his labor, and who has prob-

ably either directly or indirectly made the immigrant's coming financially possible. With three notable exceptions, viz, the Jews, the Russian-Germans, and the Armenians, some special adaptation of one or the other of these schemes is accountable for the rise into numerical importance of the racial elements from southeastern Europe and western Asia which since then have come to constitute two-thirds of our total immigration. The immigration from Greece which sprang into prominence in the nineties is due to the importation of fruit peddlers under a species of contract which amounted to servitude. Somewhat later, and until checked by special legislation, small Greek boys were imported to work in shoe-shining establishments under a similar system of bondage. The Syrian immigration, which, since the World's Fair, in 1893, has spread over this hemisphere from Labrador to Patagonia, has been recruited in practically the same way. But the modern labor supply of American labor employers has been obtained in the main through improvements on the Italian padrone idea, and to such improvement, the methods of enforcing our laws prohibiting the direct importation of labor have in no small measure contributed. Under the more highly developed phases of latter-day methods the immigrant comes, apparently as a free agent, and nominally destined to the care of a relative, real or fictitious, but actually consigned to a labor broker who has acted in conjunction with collectors abroad in making the immigrant's coming possible.

The certainty that a quick market for the immigrant's labor exists makes it a profitable financial venture for some one to advance the prospective immigrant the cost of his migration, to be repaid from future wages at an usurious rate of interest; but neither the broker nor the immigrant may know, in advance of the latter's arrival, just where he is going to be placed at work. The replacement of the old agreement between prospective immigrant and future employer idea by some form of this scheme served rapidly to augment the migration of Poles and Slovaks and to extend the movement to the Lithuanians, the Magyars, and, within the past few years, to the orthodox Russians. In a particularly efficient form this scheme brought about the Croatian immigration which rapidly came into prominence in the nineties. From then on, with some variations and improvements, the system has been applied successively to the different nationalities to the eastward, and has recently shown marked results in the Turkish Empire. It was only a few years ago that an immigration of the Bulgarians and Greeks of European Turkey began to be worked up in this way, to supplant, on railroad-construction work in the Middle West, the Italians who were joining labor unions and demanding higher wages.

The sudden industrial depression which followed the financial panic in 1907 caught those in this country who had been handling

this sort of labor with consignments that had already been started from Europe when the panic occurred. As a result, during the winter, hundreds of these newly arrived Turks, Bulgarians, and Greeks became public charges in the communities they happened to reach, and the investigations by the Bureau of Immigration which followed fully disclosed the methods by which this immigration had been brought about. With the return of industrial activity, however, this type of immigrants reappeared in increasing numbers. New fields for their labor were also found. The Mohammedan Turks and Albanians of European Turkey joined in the movement. From European Turkey, the movement has rapidly spread to the Turks of Asiatic Turkey, and from the Turks to the Kurds. Induced by somewhat different methods, an immigration of Tcherkese and Ochetchenes has also made its appearance.

In seeking new sources of labor, we are now at the threshold of Persia, where present political and economic conditions are ripe for a wholesale emigration, the vanguard of which has already started, making use of the Russian railway enterprises in the Caucasus, and thence following well-established emigrant routes across Europe.

In this immigration from eastern Europe and western Asia, which has come into existence in the last 25 years we find, as previously mentioned, but three elements of numerical importance, whose coming was not started as the result of efforts to obtain a new labor supply for the American market. The exceptions are the Russian Germans, the Jews, and the Armenians. The first are the descendants of Germans who were induced by Catharine II to settle in southeastern Russia in considerable numbers about 125 years ago. They come chiefly from the Governments of Kherson, Saratof, and Samara. They are in the main farmers and landowners, and are looking for new land and more of it than they can now find purchasable at home. They come with well-defined plans as to the general region where they intend to settle, and are usually prepared to buy land at once, but never until after they have seen it. Just now they are favoring Oklahoma, California, and the Canadian Northwest.

In the case of both the Jews and the Armenians we see a people well differentiated, not only by easily recognizable racial physical characteristics, from the general population of the countries whence they come, but by distinctive mental traits, by a religious organization, and, with few exceptions, by a language of their own. Their separateness has been further accentuated by their insistence upon special recognition and privileges from the political governments of the nations where they are found. Chiefly by means of their religious organizations, both have continuously maintained a conspicuous degree of intellectual culture dating back to the ancient oriental civilizations of which they are the modern representatives.

In intellectual capacity, in thrift, enterprise, and mechanical skill they are decidedly superior to the average of the general population which surrounds them. By their use of those qualities they have, however, aroused popular animosity and created a belief that they constitute a detriment to the general economic welfare. As a result, their emigration in both instances has been encouraged by the dominant political powers of the countries where they were living and has been favored and assisted as a philanthropic and religious duty by adherents in this country to the same religious organizations. The real exodus of the Jews to this country from eastern Europe dates back to one of the periodic waves of popular resentment that manifested itself in Europe about 25 years ago, and emigration on the large scale which followed was due to organized assistance to the movement on the part of philanthropic Jews elsewhere and to the financial resources supplied by the Baron de Hirsh fund.

The immigration of Armenians which appeared in the nineties followed in like manner an outbreak against them on the part of the Turks, and was likewise made possible by the interest awakened in Christian organizations in Europe and this country and by the direct financial assistance which the organizations supplied. In both these instances, however, charitable assistance has long since ceased to be an important factor in maintaining immigration.

In whatever way the immigration of any people may first be started, as each new arrival finds profitable employment, the latter being judged by his previous standard of living, the proceeds of his labor are utilized, like an endless chain, to make the coming of relatives or friends financially possible. Even in the case of people whose migration first appears as a virtual importation of a new labor supply, the rôle which organized commercial methods of importation may continue to play is soon obscured by the extent to which newcomers represent individual instances of financial aid on the part of relatives or friends already domiciled here.

Modern immigration is, in fact, financed by this country. Varying with different years and different seasons of the year, from 65 to 85 per cent of our total alien arrivals, at a very conservative estimate, come either on prepaid tickets or on tickets purchased in Europe and Asia with money which has come from this country. Likewise, instead of being an asset, the money which the immigrant shows to the immigration officials on his arrival is much more likely to represent a personal liability to hamper his industrial independence. There are good reasons, which I can not take time to explain, why compiled official immigration statistics do not disclose this true state of affairs.

Nor does any new element in immigration remain long exclusively identified with some restricted industrial field which may first have engaged its attention. Marked growth in the immigration of any

particular nationality or race has always followed the discovery of its ability to compete in other occupations which have hitherto been carried on by older elements of our population. The entrance into such occupations of a new immigrant type has tended to be followed by the disappearance of the people previously employed in the occupations concerned.

In so far as the previous labor supply may have been derived from an immigration of an older type, that immigration is checked. That portion of our permanent population which disappears from the field is supposed to die out or to pass on to something higher in the economic scale. To a certain extent this supposition is correct. The rapidity of the industrial development of the country has thus far offered exceptional opportunity for this latter process to take place. But there has always been a certain proportion of our older population that has been thus supplanted in the occupations with which it has been identified, and has failed to rise in the economic scale. Inefficiency of the nominal labor supply of the country has also furnished one of the strongest inducements to bring in new immigrant labor. We have been long familiar with elements of our population which are unwilling or physically unable to continue the humble toil of their immigrant progenitors, and yet have never risen to anything else of a useful character.

One-third of our immigration to-day is made up of the very same European stock that has taken part in the development of this country since the earliest days of its history. Two-thirds of our present-day immigration is composed of nationalities and races that until within the last 25 years have furnished at the most but an insignificant proportion of our population. Those of us who are brought into daily contact with this newer immigration know that the nationalities and races represented therein vary in certain general characteristics. We also know how much different individuals of the same nationality or race, even from the same locality and social stratum, vary in physical strength and mental capacity, in intelligence, thrift, and standards of morality. In every such nationality and race we are constantly meeting people of the humbler class whose personal qualities we can not help contrasting with those of individuals of the older immigrant type, to the disadvantage of the latter. There will occur to almost anybody numerous instances where individuals of every nationality or race represented in this new immigration have shown abundant proof of their ability to take care of themselves after arrival. But to a considerable extent this immigration has been furnishing social problems in the countries it has left. In our daily official duties we come to know, as belonging to a normal human adult type, the individual who can not count to 20 every time correctly; who can tell the sum of 2 and 2, but not of 9 and 6; name

the days of the week, but not the months of the year; who knows that he has arrived at New York or Boston, as the case may be, but does not know the route he followed from his home, or how long it took to reach here; who says he is destined to America, but has to rely on showing a written address for further particulars; who swears he paid his own passage, but is unable to tell what it cost; and, at the same time, shows an order for railroad transportation to destination prepaid in this country.

While physically this individual may not be open to reasonable criticism, on the other hand, we are equally familiar with another type in which mental activity is associated with glaring stigmata of physical degeneration.

As a matter of fact, we do not know yet the part that the great bulk of this immigration which has sprung into existence during the last 25 years is going to play in the future of the country. To a great extent neither these immigrants nor their American-born children have yet reached a stage of economic security. They have put in their appearance at a period of our development when unutilized natural resources of the country have become almost a negligible quantity. The industries which they have found open to them have often constrained them to live in an environment unfavorable to their physical well-being. Temperamental qualities, lack of mechanical aptitude and of physical strength impose limitations on their ability to enter the more desirable productive occupations to a far greater degree than in the case of western European immigrants. In their individual efforts to rise in the economic scale they are meeting much keener competition than the earlier immigrants ever encountered. In those fields of industrial activity where they have succeeded in establishing themselves they will soon have to meet also the competition of the western Mohammedan Asiatics, who are now following close on their heels. This competition has, as a matter of fact, already begun. On its outcome the ethnical as well as the economic results of our immigration for the last 25 years will depend.

SOME THOUGHTS ON SANITARY QUESTIONS CONCERNING THE IMMIGRANT IN HIS HOME COUNTRY AND IN THE UNITED STATES OF AMERICA.

Dr. JEAN CONSTAS, Washington, D. C.

The question of immigration has been and continues to be one of the most vital importance and a problem most difficult of solution. A great deal has been said and accomplished of late for the comfort and general uplift of the immigrant; yet, notwithstanding the establishment of educational, missionary, and labor bureaus and the ad-

mirable as well as stringent sanitary laws governing immigration in this country, a few suggestions on this important matter will not be amiss. There is hardly anything in matters of hygiene that one can advance which on one or another occasion has not been suggested. Different views, however, upon one and the same subject sometimes bring brilliant results which could not have been obtained from one alone.

I have been in very close contact with the foreign element in this country for nearly six years, and during this period I have had vast opportunities to closely observe and study their hygienic as well as their social conditions from all points of view. After due and careful consideration of this matter I take the liberty of offering to this distinguished body the following suggestions:

1. The enactment of laws by all nations, especially those concerned in the immigration to the United States of America, which will compel each immigrant to undergo a thorough physical examination by one of the physicians of his community, who shall, before his departure, furnish him with a certificate, which shall be countersigned by the mayor or some other municipal authority. The certificate should be presented to the ticket agent of the steamship company, as well as to the ship's physician at the time of engaging passage.

You can readily see the advantage of such an examination. It will enable the physician in charge of the immigration bureau of that port to eliminate all those who are physically as well as mentally afflicted. The inevitable injury to an immigrant's already impaired health that would result from traveling to so distant a country, where environment and climatic conditions are so different, will thus be avoided. It will spare his countrymen on this side of the world trouble and expense; it will facilitate the work of immigration officials in this country; and it will save the Government a great sum, for the sick immigrant will, of necessity, become a public charge.

2. That all steamship companies should be furnished with booklets written in all European languages, also in Turkish and Syrian, for distribution among immigrants on board ship. Such circulars should contain the main sanitary rules and regulations, written in the simplest and least technical manner, together with some instructions on the fundamental principles of personal hygiene.

It is a matter of common knowledge that, on a long voyage, like the one across the ocean, one's desire for reading is very great, and the immigrant will most eagerly read whatever book or printed matter he lays his hand on. Circulars, therefore, or booklets, containing a digest of the principal sanitary rules and regulations in America, written in his own language, will be practically committed to memory by the time the voyage is ended.

3. Immigrants who come in contact with typhoid-fever patients should be detained in the same way as those who have been in contact with other contagious diseases, and should receive antityphoid vaccine. Also, those coming in contact with epidemic cerebrospinal meningitis should be detained for a longer period than heretofore.

4. On landing in America, another class of circulars and pamphlets written in all European languages, as well as in Turkish and Syrian, should be distributed among the immigrants. These circulars and pamphlets should contain the sanitary laws existing in this country, with directions as to their observance, and, above all, the statement that fine and imprisonment are imposed as penalties for disobedience.

5. It should be the duty of the health officer and his assistants to post, in the most conspicuous place in the houses where aliens live, placards or notices written both in English and their own language. These notices will contain the principal sanitary regulations, as well as the laws of personal hygiene, emphasizing that the rules therein should be strictly observed, and that any violation of them will be considered a misdemeanor punishable by fine and imprisonment.

6. That fly screens should be furnished at cost, by the village, town, or city authorities, to persons unable to purchase them in the shops.

How many of the physicians who attend immigrants living in tenements and alleys have shuddered at the sight of the great swarms of flies completely covering the tender eyes and mouths of little babies! As for the milk bottle, if the baby were so unfortunate as to be fed from one, it would remind us of the hideous spectacle of ravens and other rapacious birds blackening the sky above and about a mass of carrion by the roadside. Is there anyone in this great gathering who can fail to see the untold harm done to these innocent and helpless infants? I am sure that the distribution of screens among the poor at a nominal price is as important and imperative as any other means for the protection and care of the baby, and for the prevention of the spread of infection and contamination through that relentless foe of humanity, the fly.

7. That the health officer or his assistants should in the very beginning see that the law is carried out to the letter, for the slightest oversight at this time will greatly increase the difficulties of his task in the future. Once the immigrant realizes that he must obey the law he will most surely do so.

8. That all reputable, licensed, nonadvertising physicians should be invested with sufficient authority to enable them, if necessary, to enforce the sanitary laws. Unless such cooperation between physicians and health officers exists I am afraid that all other efforts will be of but little avail. Physicians attending aliens can accomplish

more in hygiene and sanitary matters than any other person or society.

9. That it shall be the duty of the physician who treats immigrants always to endeavor to kindly and persuasively instruct his patients and their friends in all matters pertaining to sanitation and personal hygiene.

He should explain the object of the screens. He should impress upon his patients the way diseases are spread by promiscuous expectoration. He should, as practicably as possible, explain to them how mosquitoes and their allies, the flies, carry the most dangerous diseases. He should by all means attempt to explain to them that closed windows and lack of fresh air weaken and predispose the body to disease; that too many sleeping in one room poison one another; that if they keep their babies in the so-called living room, where so many are smoking and talking loudly, their offspring will become physically as well as morally deteriorated. He should endeavor to abolish the erroneous idea prevalent among most of them that bathing is the forerunner of all colds and diseases of the chest. In other words, he should be ever ready to help them carry out at least the principal sanitary and personal hygienic rules. On the other hand, he should impress upon his patients and their companions that although he is their medical adviser and friend, yet he is also a health officer, responsible for their faults, and that it is his duty to enforce the law when occasion arises. In my six years' experience among almost all classes and nationalities of foreigners in this country, I have in but few instances seen a person commit a second time an offense for which he was punished once.

10. Monthly or semimonthly illustrated lectures on sanitary matters should be given right in the immigrants' quarters; these will be of vast benefit and help to physicians, as well as to health officers, in carrying out their most arduous work among the immigrants.

All we need is but a little time in order to familiarize ourselves with the mode of living of "the other half," and to systematize our methods of instruction, and the task will not be so difficult as it appears.

The percentage of tubercular cases in Greece, as far back as 25 years ago, was almost insignificant; whereas since the immigration of Greeks to this country began the percentage is appalling. The Greek authorities were recently so alarmed that they began to consider the matter very seriously. There is already one hospital for tubercular patients in operation, and a second of the kind is under construction. Fifty per cent of the tubercular patients in Greece are people who have lived in this country. The death rate among those who have returned home to seek the restoration of their lost health is

excessive; nearly 40 per cent died. Aside from this, the spread of tuberculosis among the relatives of the patients is embarrassing the Government of Greece to a high degree. Venereal and skin diseases (principally the former) are two other scourges which show an alarming percentage.

Nearly one-third of the immigrants afflicted with various diseases have become public charges to this country and the cause of the utmost embarrassment to the various Greek communities here; for the Greeks in America feel it to be their duty to provide and care for the sick. The prevalence of rickets and various intestinal troubles among their offspring, who are to be reckoned among the Americans of the future, is another matter worthy of notice and consideration. There is no doubt, in my opinion, that a practical and more systematic application of the laws governing sanitation and personal hygiene among these people and the native American poor will bring the greatest results.

It is practical hygiene that we want for the masses. We must look to the earnestness and diligence of conscientious physicians practicing among these people for the best results. Only by means of the hearty cooperation of the latter with the health officer will the sanitary laws be respected and observed.

The money spent and the systematic work done for the civilization and Christianization of our savage brethren in Africa and elsewhere is a great thing. But it is equally, if not more, important and humanitarian that a portion of the money thus spent be utilized for the uplift and care of the body and mind of our neighbor next door. Let us not forget the scriptural injunction that "the body is the temple of the Holy Ghost"; consequently, it must be pure and holy.

TWIN NAVIGATION; THE MEANS OF SAFEGUARDING LIFE AND SECURITIES ON SEA.

Dr. Miguel Beccerro de Bengoa, Uruguay.

The terrible catastrophe which has taken place in the North Sea has attracted the attention of all men and of all nations, following that profound consternation which invades society whenever an event of this kind shocks the highest sentiments of mankind.

One and all of those astonished at the gigantic proportions of the disaster, which is being commented upon by the press of the whole world, having recovered from the first shock, unfailingly ask themselves what the cause of such an awful disaster is; why such misfortunes assume the magnitude which they do; why the despair of the actors is so shameful and unheard of, who, at midnight and in the midst of dazzling splendor, are driven to blow out their brains in the face of the justifiable despair created by the idea of a sure death.

In contrast with the regal embellishments of the cabins, the brilliant decorations of the large halls, the kingly presentations of all things that please, all that make for enjoyment, are the fragile and miserable means of salvation which the steamship companies put at the service of passengers; as if, when a ship is built, they looked only after the pleasures, without thinking of the danger, and imagined calm seas and everlasting happiness, without a care for the hurricanes of adversity.

Then the unskillfulness of a captain in a fight against the elements causes the beautiful craft to founder, and to carry to the depths of the ocean the gold, diamonds, and all the life that floated proudly, propelled by prosperous fortune.

Pleasures seduce man and he forgets his grief. He thinks more of happiness than of misfortune. He is more interested in the sweetness of life than in its continuation. This is why one must preserve that predilection for what is agreeable, at the same time causing the disappearance of all moments of bitterness; we must efface the idea of death without taking from life its enchantments; one must impress mankind with the idea that maritime disasters of the future will not be horrible and hopeless.

Travelers of the future must be taught that life on the sea may be less dangerous than life on land, since on the latter they may die from violence and help arrive too late; but on the sea they always die slowly by water, cold, and exhaustion of physical energies.

Once the fatal shock was sustained by the vessel the shipwrecked occupants of the *Titanic* remained more than three hours on the sea without a sign of help upon the horizon, and during that length of time 1,600 lives succumbed to water, cold, and despair; but, thanks to the marvelous invention of Marconi, 640 souls live to relate to humanity the gigantic proportions of that disaster.

A logical and important inference results from these thoughts, and that is, that if there had been at a short distance from the shipwrecked vessel another ship, to-day we should have to lament only the loss of the most beautiful craft of the present time, because the *Carpathia* would have arrived in time to stretch out her succoring arms to one and all of the travelers on the *Titanic*.

This, which at first sight appears an evident truth, contains a useful lesson.

It shows that, since it is hardly possible to avoid the loss of vessels, there is a way, perhaps the only one, to avoid the loss of life.

What is only lacking is international legislation which would create what might be called twin navigation, establishing an agreement obliging the companies and the governments to organize navigation in such manner that passenger steamers should always sail teamwise—one in sight of the other. This could be enforced by the

governments through mutual agreement should the companies not do so, or at least in the beginning be started by one company. In the first instance, the new navigation system could be generalized by law; in the second instance, by motives of convenience; and in the last instance, induced by competition.

Up to the present time, and in spite of the mournful results of this practice, ships filled with passengers have plowed the seas destitute of all protection, subject to all the contingencies of the route, no known reason meanwhile existing to make this dangerous single sailing indispensable. Voyages in solitude are imprudent and dangerous, because the calculated resistance of mechanical construction or of organisms is opposed to the unknown powers and sometimes to the infuriated elements of nature.

Legislators and governments have always placed at the service of society a series of guarantees for the conservation of order, the maintenance of life, and the consolidation of respect among its constituent elements, and the want of all those things which on land constitute hope and faith in the help and protection exchanged between men makes disasters at sea the most incomprehensible and despairing of things; and when, from whatever cause, a vessel is wrecked with all of its occupants, they are surrounded only by the infinite solitude of the sky and of the seas and the hope that chance may send help before water, cold, or despair have put an end to their lives.

This is why solitary sailing on the sea is an incomprehensible and barbaric custom. And since the present means of defense are impotent, as shown by indisputable facts, a form of navigation must be adopted which will guarantee life, or at least lessen danger; that will make one think of help when misfortunes occur; that will strip from shipwrecks the stigma of disaster which they at present bear, making sea traveling as safe as that on land.

All this could be secured if the governments dictated laws establishing twin navigation, which marine experts would know how to organize in a wise and advantageous manner.

If the *Titanic* had sailed in sight of her twin ship, to-day we would not have to lament the loss of one single life.

If there were commercial inconveniences these would never be so important as social conveniences.

This alone ought to suffice to attract the attention of governments to this valuable proposition.

THE POSITIVE ADVANTAGES.

Having roughly sketched in the former chapter the inconveniences and dangers of solitary sailing and pointed out the easy, practical, and sure manner of averting catastrophies, it remains now to point

out the practical part of the problem, so as to establish the fact that twin navigation, well organized, is the only form that in future can actually guarantee life in the solitude of the seas.

By making a brief examination of the means now in use we see that they can not, except in very favorable cases, safeguard the lives of shipwrecked persons, and that all of them fail when the means of salvage are really necessary.

The life belts only serve in cases when help arrives soon; on the other hand, but a few hours suffice for the cold and the water to consume the physical energies of the majority or all of the shipwrecked. They prolong life but do not save it.

Passengers of the *Titanic* with left belts were picked up in great numbers.

The lifeboats are subject to the same defects, having, moreover, the objection that large waves, and even the disorder of the shipwrecked persons, capsize these small craft, causing the death of those who thought themselves saved. On the surface of the water in the place of the disaster boats have been found abandoned, which makes it seem probable that their occupants have drowned.

And more, the survivors declare that in order to maintain the equilibrium of the boats they had to witness the death of many of the shipwrecked, and even to cut off the hands of some in the water who persisted in clinging to the sides of the boats.

The unsinkable ships very seldom have given the wished-for results, for it is not possible to calculate the proportions of the disaster in order to affirm that one compartment will be opened and that that branch will not allow the sinking of the larger part of the ship or the contact of the water with the boilers, which brings the explosion and the final disaster.

On the other hand, life is impossible for more than a few hours even to the strong, and impossible for the rest when they have to remain on an inclined plane suspended to a rope or on the top of a mast for an indefinite time.

The life belts and unsinkable ships in the most favorable cases only serve their purpose of salvation for a short time, and they will not give positive results while single vessels exist at sea. At least twin navigation would do away with the very gallant but horrible law obliging the man to give his place to women and children, forcing them to abandon their mothers, their wives, and children, adding to the disaster of the seas the dismemberment of the family.

It is easy to understand that all these obstacles will disappear with twin navigation, and there only remains against it, as against all actual and future systems, the danger of the great storms, and even in that case only if both vessels should be wrecked, which is hardly within the bounds of probability.

If the commerce of to-day is organized in such a way that it would be damaged by the new form of navigation; if commerce suffers somewhat with the establishment of twin navigation—a thing which would have to be shown, for there is no tangible reason to prove it—what does that signify beside the enormous benefits to society and to commerce accruing from twin navigation?

For how many commercial grievances would not England and the United States have exchanged the disaster of the *Titanic*?

For how many commercial grievances would not the nations of the world have exchanged the 1,700 lives that were lost there, thanks to the inexplicable single sailing of ships on the ocean?

For how many grievances would not the companies of the world have exchanged all the millions of dollars that were lost forever on the tragic night of the disaster?

It does not take long to answer. All the partial grievances are not worth what the disappearance of a ship costs, just as all the trifling worries of life can not be compared with death.

And, finally, if that were not enough, those damages, if they exist, could be covered by a slight increase in freight and passenger charges that the public would pay, since they would be interested in the security of navigation.

Commerce is sustained by the consumers, and the consumers are the travelers who demand guaranties and are willing to pay for them.

It has also been said that this proposed new form of navigation would be dangerous. This can not be true for the following reasons:

First. Because twin navigation does not imply absolute proximity, but is understood to mean that the ships shall be always within sight of each other, which allows a maximum distance of no less than 7 miles.

Second. Because, in case of fog, the only case in which danger might exist and in which collisions are possible, with twin navigation the danger disappears, because the vessels would be on the lookout for them.

The continued certain knowledge of the proximity of the twin vessels would by itself make a collision between them improbable; moreover, the agreed signals of the speaking trumpet or telegraph in use for this object would be an added means of assurance against a collision.

Third. Because collisions between ships always take place when they are going in opposite directions and never between ships, vehicles, or persons advancing in the same direction, as in twin navigation. And finally, should all of this not be sufficient, the telephone and the Marconi compass are sure to render invaluable service.

Things organized in such a manner would cause a transformation in sea voyages and would make them safer than travel on land. The confidence of the passenger is absolute, because he always sees at a short distance away the protecting vessel which would come to pick him up in a few moments if he were afloat with his life belt;

from the boats, if he has succeeded in occupying them; or, in most cases, from the deck of the wrecked vessel, since it is rare for a ship to sink before 15 minutes or half an hour—time sufficient for the twin vessel to cover the maximum distance of 7 miles which comprises the maritime horizon.

Under those conditions neither lives nor securities would be lost and the horror of shipwreck would disappear.

If governments, giving a definite proof of practical good sense, would oblige the companies to adopt this form of navigation, the terror of the seas would disappear.

Those who have not grasped the idea have said that this new form of navigation would be very expensive, because the number of vessels would have to be duplicated. We can only answer that, of all the good points possessed by twin navigation, it is the best, for it is not possible to imagine a measure that will avert so many disasters and cost such little sacrifice as this.

Any one of the means of safety published throughout the world with relation to shipwreck would cost the companies millions and millions, without being a guaranty of safety.

Twin navigation, while giving guaranty, would cost each country the insignificant sum spent for a sheet of stamped paper, upon which would be drawn up a decree somewhat after the following fashion:

DECREE.

In consideration thereof the Government decrees:

First. Three months after the promulgation of the present decree the shipping companies will arrange their time-tables in such a manner that passenger ships will travel in pairs.

Second. All steamers carrying passengers, not complying with the former regulations, will not be allowed to sail.

Third. The pairing will be effected between steamers of the same company, or if more convenient, between those of different companies.

Fourth. The time-tables will be arranged in the same manner as is done now, and for the whole year, indicating a fixed date of departure for each pair. For example: On the 15th of September the steamship *Mauretania* and the steamship *Olympic* will sail with freight and passengers.

Fifth. In accordance with this, the steamship *Mauretania* will always sail in sight of the steamship *Olympic*, and vice versa, and they will always be twin ships. Should it be necessary, the companies will change their itineraries in order to comply with this new law.

The twin navigation thus organized will comply in all its parts with the regulation arranged by an international convention which will meet with that object and which will fix a system of signals and determine all the mutual obligations which will exist between twin vessels, companies, and nations.

CONCLUSIONS.

1. The horrors of the sea and its great dangers would disappear through an international agreement of the sort between the various governments or various shipping companies.

2. There is no reason against the establishment of twin navigation; on the contrary, there are many justifying circumstances which demand such a new form of navigation.

In the beginning, the new law would be obeyed within the limits of possibility, and a maximum time would be given the various shipping companies for the total observance of the law.

4. A perfect organization of the new navigation system would not cause any difficulty to commerce, because 10 pairs of vessels would carry the same quantity of cargo and the same number of passengers as would 20 ships sailing singly. In the first instance, the commerce would be guaranteed; in the second, it would not.

5. Lives and property would be saved.

6. Steamship companies, and the various governments especially, are urged to adopt this humanitarian measure.

The proceedings of the Joint Sessions of Sections VII and V and of the Joint Sessions of Sections VII and VI are found in Volume I, Part II.

TRANSACTIONS

OF THE

Fifteenth International Congress on Hygiene and Demography

WASHINGTON

September 23–28, 1912

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EDITED BY THE SECRETARY GENERAL

VOLUME V

PART II.—PROCEEDINGS OF SECTION VIII

Military, Naval, and Tropical Hygiene

WASHINGTON
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1913

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SECTION VIII.

MILITARY, NAVAL, AND TROPICAL HYGIENE.

REPORT OF THE SECRETARY.

Dr. Henry G. Beyer,

President Section VIII, Fifteenth International Congress on Hygiene and Demography.

Sir: In accordance with the provision of Article XII of the regulations of the congress, I herewith submit a report of the proceedings of Section VIII during the meeting held at Washington, September 23 to 28, 1912, together with such manuscripts of the papers read as have been delivered into my hands.

Monday, September 23, 4 P. M.

The first session was called to order by the president, Medical Director Henry G. Beyer, United States Navy.

The president announced the following honorary presidents of Section VIII:

Surg. Gen. George M. Sternberg, United States Army (retired), Surg. Gen. Presley M. Rixey, United States Navy (retired), Surg. Gen. Simon von Unterberger (Russia), Surg. Gen. A. C. J. Bornemann (Denmark), Marine-Generaloberarzt Dr. H. Hoffmann (Germany), Generaloberarzt Dr. Hamann (Germany), Médecin-en-chef Dr. Prosper Barthélémy (France), Oberstabsarzt Dr. Walter Fornet, Kaiser Wilhelms Akademie (Germany), Prof. Dr. Ludwig Brieger (Germany), Prof. Dr. Friedrich Fülleborn (Germany), Dr. Alberto Adriasola (Chile), Dr. Luis Figueroa (Chile), Oberstabsarzt Dr. von Vagedes (Germany), Marine-Oberstabsarzt Dr. August Weber (Germany), Stabsarzt Dr. Carl Hüne (Germany), Marine-Oberstabsarzt Dr. Hennig (Germany), Surg. Gen. A. A. Zohrt (Russia).

Papers were presented in the symposium on venereal prophylaxis in armies and navies as follows:

Bekämpfung der Geschlechtskrankheiten im Heere, by Oberstabsarzt Prof. von Vagedes, Danzig, Germany.

Prophylaxis of Venereal Diseases in the Army and Navy, by L. Mervin Maus, colonel, Medical Corps, United States Army, and chief surgeon, Eastern Division.

Venereal Prophylaxis in the United States Navy, by Medical Inspector George A. Lung, United States Navy.

Venereal Prophylaxis in Armies, by Deane C. Howard, major, Medical Corps, United States Army.

Die Verhütung der venerischen Krankheiten an Bord von Kriegsschiffen, by Marine-Oberstabsarzt Dr. G. A. Rost, Kiel, Germany.

Prophylaxis of the Venereal Diseases in the Russian Navy, by Surg. Gen. A. A. Zohrt, Imperial Russian Navy.

The next topic for consideration by the section was hospital ships. The following papers were read:

The Hospital Ship: A Component Part of the Fleet, and the Repair Ship for the Personnel, by Charles F. Stokes, Surgeon General, United States Navy.

The Hospital Ship as a Permanent Unit of the Fleet, by Fleet Surgeon D. McNabb, R. N., Portsmouth, England.

The Dimensions, Construction, and Functions of Hospital Ships, including Handling of the Sick, by Medical Inspector George Pickrell, United States Navy.

The following members of the congress took part in the discussion:

Dr. E. M. Simons (Berlin), Dr. C. M. Belli (Venice), Marine-Generaloberarzt Dr. Hoffmann (Berlin).

TUESDAY, SEPTEMBER 24, 9.15 A. M.

The second session was called to order by the president, Dr. Henry G. Beyer.

In the symposium on dressing stations and transportation of the wounded in battle at sea the following papers were read:

The Care and Transportation of the Wounded during and after an Action at Sea, by Charles F. Stokes, Surgeon General, United States Navy.

Concerning the First Treatment of the Wounded in Sea Battles, by Surg. Gen. Dr. A. C. J. Bornemann, R. N., Denmark.

Entwicklung und heutiger Stand des Verwundeten- Transport und Versorgungswesens in der Deutschen Marine, by Dr. H. Hoffmann, Marine-Generaloberarzt im Reichs-Marine-Amt, Berlin.

Stations de pansements et transport des blessés dans les combats sur mer, by Dr. Prosper Barthélémy, médecin-en-chef de la Marine, France.

Some Sanitary Problems on Hospital Ships, by Surg. E. M. Blackwell, United States Navy.

The subject of hospital ships was discussed by Dr. A. A. Zohrt, of the Imperial Russian Navy.

The section then gave attention to general considerations of camp hygiene. The following papers were read:

Der Einfluss gesunder Keimträger bei der Verbreitung der Seuchen, mit besonderer Berücksichtigung der Truppe im

Frieden und im Kriege, by Stabsarzt Dr. Carl Hüne, Stettin, Germany.

Das Lager von Krassnoje-Sselo in sanitärer Beziehung, by Surgeon General Dr. Simon von Unterberger, honorary physician to His Majesty's Court, St. Petersburg, Russia.

The Personal Hygiene of the Soldier Man from the Viewpoint of his Officers, by John Van Rensselaer Hoff, colonel, United States Army (retired).

The Disposal of Wastes, by Joseph H. Ford, major, Medical Corps, United States Army.

The Disposal of Human Excreta in Military Camps, by P. M. Ashburn, major, Medical Corps, United States Army.

The subject of the disposal of excreta was discussed by Maj. Bailey K. Ashford, United States Army (Porto Rico).

TUESDAY, SEPTEMBER 24, 2 P. M.

The third session was called to order by the president, Dr. Henry G. Beyer.

Consideration of the subject of camp hygiene was continued. The following papers were read:

Alimentation en eau de boisson des troupes en campagne, by Médecin Inspecteur Général Février, Paris, France.

The Purification of Water for Troops in Time of War, by C. R. Darnall, major, Medical Corps, United States Army.

The following papers were read in the symposium on the hygiene of engine and fire room force:

The Influence of High Wet-Bulb Temperatures in the Engine Room and Stokeholds of Ships in the Tropics, by Fleet Surg. Oswald Rees, British Royal Navy.

Hygiene of the Engine-Room Force, with Special Reference to the Effects of Heat and Humidity, by Surg. F. L. Pleadwell, United States Navy.

Hygiene of Engine and Fire Room Force, with Special Reference to Ventilation, by Surg. R. C. Holcomb, United States Navy.

WEDNESDAY, SEPTEMBER 25, 9.15 A. M.

The fourth session was called to order by Dr. Frederick G. Novy, vice president of the section.

The following papers were read in the symposium on the control and restriction of malaria:

The Restriction of Malaria in Italy, by Prof. Angelo Celli, University of Rome, Italy.

Die Bekämpfung der Malaria, by Marine-Generalarzt Prof. Dr. Reinhold Ruge, Kiel, Germany.

Rapport sur la lutte contre le paludisme, by Dr. Edmond Sergent, Algiers.

Recent Progress in Antimalaria Work, with Special Reference to Anopheles Flight as Studied on the Isthmus of Panama, by J. A. Le Prince, Chief Sanitary Inspector, Isthmian Canal Commission.

A National Commission for the Study and Prevention of Malaria, by Charles F. Craig, captain, Medical Corps, United States Army.

The following members of the congress joined in the discussion:

Dr. A. J. Orenstein (Panama), Col. L. Mervin Maus (New York), Dr. Olpp (Tübingen), Col. Valery Havard (Fairfield, Conn.), Mr. Frederick Knab, Prof. Creighton Wellman (New Orleans), Dr. W. S. Thayer (Baltimore), and Capt. Charles F. Craig (Washington).

The subject of the dissemination and prevention of yellow fever was considered.

The following papers were read:

The Dissemination and Prevention of Yellow Fever, by Dr. J. H. White, United States Public Health Service, New Orleans, La.

The Nature and Control of Yellow Fever, by Dr. Harald Seidelin, School of Tropical Medicine, Liverpool, England.

The following members of the congress took part in the discussion of these papers:

Col. L. Mervin Maus (New York), Dr. Eduardo Licéaga (Mexico), Capt. Charles F. Craig (Washington), Dr. A. J. Orenstein (Panama), Prof. Creighton Wellman (New Orleans), and Dr. Harald Seidelin (Liverpool).

WEDNESDAY, SEPTEMBER 25, 2 P. M.

The fifth session was called to order by Dr. Frederick G. Novy, vice president of the section.

The topic for consideration was the means of combating sleeping sickness. The following papers were read:

Rapport sur la prophylaxie de la maladie du sommeil, by MM. Laveran, Paris, and Thiroux, Sénégal.

The Treatment of Trypanosoma Infection By Means of Certain Pigments, by Prof. Dr. Ludwig Brieger, Berlin.

The Prevention of Human Trypanosomiasis in Africa, by Prof. John L. Todd, McGill University, Montreal.

Immunization by means of Cultures of Trypanosoma Lewisi, by F. G. Novy, W. A. Perkins, and R. Chambers, from the Hygienic Laboratory, University of Michigan, Ann Arbor.

Sur la prophylaxie des trypanosomiases, by Prof. F. Mesnil and E. Roubaud, Pasteur Institute, Paris.

Trypanosoma Rhodesiense, by Drs. J. W. W. Stephens and H. B. Fantham, University of Liverpool, England.

Murrina, a Trypanosomal Disease of Horses in Panama, and the Means used in Controlling an Outbreak, by Dr. Samuel T. Darling, chief of laboratory, Isthmian Canal Commission, Ancon, Canal Zone.

The program set for the fifth session having been concluded, that portion of the program originally scheduled for Friday morning was begun.

The subject for discussion was tropical hygiene in general. The following papers were read:

Origine et rapports du kala azar et du bouton d'Orient, by Charles Nicolle, Pasteur Institute, Tunis.

The Etiology, Prevention, and Cure of Beriberi, by Henry Fraser, M. D., director, Institute for Medical Research, Kuala Lumpur, Federated Malay States, and A. T. Stanton, bacteriologist, Institute for Medical Research, Kuala Lumpur, Federated Malay States.

The Prevention of Beriberi, by Edward B. Vedder, captain, Medical Corps, United States Army.

The Etiology of Beriberi, by Prof. Dr. Richard P. Strong, chief, Biological Laboratory, Bureau of Science, Manila, P. I., and B. C. Crowell.

Zur Differentialdiagnose der Blutmikrofilarien, by Prof. Dr. F. Fülleborn, Institut für Schiffs- und Tropenhygiene, Hamburg, Germany.

Sunlight, by Paul C. Freer and H. D. Gibbs, of the Bureau of Science, Manila, P. I.

THURSDAY, SEPTEMBER 26, 9.15 A. M.

The sixth session was called to order by the president, Dr. Henry G. Beyer.

In the symposium on personal hygiene, including disinfection of clothing and equipment with and without apparatus, the following papers were read:

Desinfektion auf Kriegsschiffen, by Marine-Generaloberarzt Dr. Richelot, Kiel, Germany.

Disinfection on Shipboard, by Surg. E. G. Parker, United States Navy.

Formaldehyd-Raumdesinfektion ohne Apparate, mit besonderer Rücksicht ihrer Anwendbarkeit bei der Truppe im Frieden und im Kriege, by Stabsarzt Dr. Carl Hüne, Stettin, Germany.

Personal Hygiene in the Field, including the Disinfection of Clothing and Equipment with and without Apparatus, by Valery Havard, colonel, United States Army.

Gaseous Disinfection of Equipment in the Field, by Edward L. Munson, major, Medical Corps, United States Army.

Personal Hygiene in the Field, including the Disinfection of Clothing and Equipment with and without Apparatus, by Powell C. Fauntleroy, major, Medical Corps, United States Army.

The following members of the congress joined in the discussion:

Brig.-Gen. A. C. Girard (Washington), Lieut. Col. F. R. Keefer (West Point), Stabsarzt Dr. Carl Hüne (Germany).

The next topic for consideration was vaccines, with respect to their practicability and promise according to results already obtained in the army. The following papers were read:

The Prevention of Typhoid Fever by Bacterial Vaccine, by Frederick F. Russell, major, Medical Corps, United States Army, and director of the bacteriological laboratory of the Army Medical School, at Washington.

The Results of Antityphoid Vaccination in Foreign Armies, by Charles F. Craig, captain, Medical Corps, United States Army.

An Analysis of Antityphoid Vaccines and a Consideration of Their Relative Practical Value at the Present Time, by Henry J. Nichols, captain, Medical Corps, United States Army.

Verbreitung der übertragbaren Krankheiten in den europäischen Heeren und neuere Fortschritte in der Bekämpfung dieser Krankheiten, by Oberstabsarzt Prof. von Vagedes, Danzig, Germany.

Typhusentstehung und Typhusverhütung, by Stabsarzt Dr. Walter Fornet, Kaiser Wilhelms Akademie, Berlin, Germany.

Ein neues, eiweissarmes Typhusvaccin, by Stabsarzt Dr. Walter Fornet, Kaiser Wilhelms Akademie, Berlin, Germany.

The following members of the congress joined in the discussion:

Maj. Bailey K. Ashford, United States Army (Porto Rico), Dr. Federico Torralbas (Habana), Maj. Frederick F. Russell (Washington), Dr. Walter Fornet (Germany).

THURSDAY, SEPTEMBER 26, 2 P. M.

The seventh session was called to order by the president, Dr. Henry G. Beyer.

The following papers were read:

Prevention of the Spread of Infectious Diseases on Shipboard, by Medical Inspector E. R. Stitt, United States Navy.

L'air dans les submersibles plongés, by Dr. C. M. Belli, médecin principal de la Marine Royale Italienne, Venice.

A Hygienic Interpretation of the Food Supplied the United States Army in the Field, as at present authorized, by Brig. Gen. Alfred A. Woodhull, United States Army, Princeton, N. J.

Hygienic Interpretation of Recent Changes in the Field Rations and their Preparation, by Henry C. Fisher, lieutenant colonel, Medical Corps, United States Army.

Value to the Army in Changes in the Ration and its Preparation, by Capt. M. A. Elliott, jr., Subsistence Department, United States Army.

The following members of the congress took part in the discussion:

Surgeon F. L. Pleadwell (United States Navy), Surgeon Charles N. Fiske (United States Navy).

It was here suggested by the president that some of the work upon the subject of an international basis for naval statistics, scheduled for the Saturday morning session, be undertaken at this session. Accordingly the following papers were read:

General Statistical Data relating to Health Conditions in the Navy of Chile, by Fleet Surg. Maj. Alberto Adriasola, Chilean Navy.

Statistik über (eventuelle) Zunahme der Blinddarmentzündungen in der Marine und ihre Ursachen, by Marine-Oberstabsarzt Dr. Hennig, Berlin, Germany.

An International Basis for Naval Statistics, by Surg. A. W. Dunbar, United States Navy.

International Basis for Naval Statistics, by Surg. Charles N. Fiske, United States Navy.

FRIDAY, SEPTEMBER 27, 9.15 A. M.

The eighth session was called to order by the president, Dr. Henry G. Beyer.

A paper on An International Basis for Naval Statistics was read by Dr. Cressy L. Wilbur, of the United States Census Bureau.

Surg. Charles N. Fiske, United States Navy, offered the following resolution regarding an international basis for naval statistics:

Whereas the medical departments of the several navies have no uniform methods for expressing morbidity or mortality statistics, either in nomenclature for causes of disability, or in compilations and tabulations of returns, and

Whereas the International Classifications of Causes of Death and Sickness should form a basis to secure uniformity in all naval vital statistics; therefore be it

Resolved, That the Secretary General of the Fifteenth Congress on Hygiene and Demography, now in session in Washington, is directed to communicate to the Governments of France, Germany, Great Britain, Italy, Japan, Russia, the United States of America, and such other nations as publish naval medical returns, that it is the sense of this congress that each Government should designate naval medical representatives to confer, and recommend uniform methods and tables for expressing internationally naval vital statistics.

A vote was taken, and the resolution was adopted.

The following resolutions, proposed by Dr. A. Adriasola, fleet surgeon major, Chilean Navy, arrived too late to be submitted to the section or the congress, but are recorded in these minutes:

First. Adoption of a single medical-surgical classification for all the navies represented in the congress.

Second. To ask or recommend to the Governments represented in the congress, that they arrange for the proper position of the sanitary post of aid to the wounded in battle, as well as the distinct permanent sanitary location of men-of-war in studying and forming the plans of it, the medical authorities to be in accord with the naval constructors. These matters being of so much interest to naval hygiene, it is urgent that they should be better attended to by the countries having fleets, and if the congress should recommend them, surely the Governments would adopt them.

FRIDAY, SEPTEMBER 27, 2 P. M.

Joint session with Section I. For program see the report of the secretary of Section I.

Reports of discussions as given to the secretary will be found in the transactions of this section.

Respectfully,

JAMES C. PRYOR,
Surgeon, United States Navy, Secretary.

MONDAY AFTERNOON, SEPTEMBER 23, 1912.

BEKÄMPFUNG DER GESCHLECHTSKRANKHEITEN IM HEERE.

Oberstabsarzt Prof. von Vagedes, Danzig, Germany.

Der Vortragende gibt eine Uebersicht über die Verbreitung der Geschlechtskrankheiten in dem Heeren von 6 verschiedenen Gross-Staaten Europas (Lichtbild); danach sind diese Krankheiten am verbreitetsten im italienischen Heer; es folgen der Häufigkeit der Geschlechtskrankheiten nach das englische, österreichische, russische, französische und endlich das deutsche Heer. Alsdann werden die bisher erprobten Bekämpfungsweisen besprochen, zum Teil auf Grund eigener Erfahrungen des Vortragenden.

SCHLUSS-SÄTZE.

(1) Die Bekämpfung der Geschelechtskrankheiten muss gleich der Zahnkrankheiten bereits in der Schule durch sachgemässe Aufklärung über die Geschlechtsvorgänge beginnen (Belehrung durch Aerzte).

(2) Bekämpfung und Regelung der Prostitution.

(3) Gesundheitsbesichtigungen und regelmässige Belehrung der Soldaten. Verpflichtung des Soldaten zu sofortiger Meldung im Erkrankungsfalle.

(4) Bereitstellung von Mitteln für den Soldaten zur Verhütung der Erkrankung nach ausserehelichem Geschlechtsverkehr und strenge Durchführung dieser prophylactischen Behandlung.

PROPHYLAXIS OF VENEREAL DISEASES IN THE ARMY AND NAVY.

L. Mervin Maus, colonel, Medical Corps, United States Army, and chief surgeon, Eastern Division.

Since the elimination of malarial affections, as a result of the brilliant discoveries of Laveran, Ross, and other investigators our vital statistics have shown no factor which has contributed more to the nonefficiency of the Army and Navy than venereal diseases.

The marked increase in this morbidity since 1901 has attracted the attention of military and naval hygienists of our services to the subject generally, a number of whom have ascribed the increased

incidence to the abolishment of the canteen from the post exchange, which occurred during that year. I do not believe, however, that the removal of the canteen had anything to do with the increase of venereal diseases in the Army.

There seems to be little doubt that diseases of vice were quite as prevalent at many of the posts in the Army before the Spanish War as they have been since that period, although not susceptible to proof by statistics. Medical officers who served before 1898 understand generally that not more than 33 per cent of venereal cases were made of record during that period. It will be remembered, also, that venereal inspections were not instituted before 1898, nor were these diseases taken up "for record only," as is now the case.

Although inspections and venereal prophylaxis have occupied the attention of medical officers for more than a decade, this important branch of military hygiene never received official recognition from the War Department until the publication of General Orders 17, which were issued May 31 of the present year.

Notwithstanding the silence of the central authorities on the subject, regular physical inspections of men were begun as early as 1898 in the Seventh Army Corps, and, in 1899, among the regiments leaving San Francisco for the Philippines.

In 1901 Gen. MacArthur, at that time Governor General, issued General Orders 101, which required biweekly venereal inspections of the entire Army in the Philippines. These were the first general orders ever published on the subject in our service.

The examinations were made twice monthly and had the effect of doubling the venereal incidence in the islands. Similar inspections were made in the United States among home-coming regiments, which naturally resulted in an apparent increase of venereal diseases among the troops in the United States also.

The study of the "great red plague" has been the subject of frequent conventions, international as well as national, during the past generation, and heretofore has accomplished little beyond recommendations for educational campaigns and moral suasion.

March 18, 1902, the Secretary of War issued a circular to the Army inviting attention to venereal diseases and alcoholic addiction, which was introduced by the following remarks:

> The only really efficient way in which to control diseases due to immorality is to diminish the vice which is the cause of these diseases. Excessive indulgence in strong drink is absolutely certain to ruin any man, physically and mentally, while diseases due to licentiousness produce effects which are quite as destructive and even more loathsome.

Notwithstanding the publication of this highly moral encyclical, the annual venereal rate increased in the Army from that date until 1905, when it reached the highest figure on record.

Happily for the present generation the educated world has begun to realize that the three great social cankers—alcoholic addiction, prostitution, and venereal diseases—must be met by scientific and rational measures. Why attempt longer to conceal in the closets of social life these ghastly skeletons which for centuries have been gradually but surely gnawing their way to the very heart of human existence?

Venereal diseases are intimately associated with two of the most prominent sociological problems of the age, namely, alcoholic addiction and prostitution, and, assisted by the increasing immoral tendency, will, if not checked, lead to a declining birth rate, degeneracy, and possibly racial annihilation.

Alcohol plays such an important rôle in the contraction of venereal diseases that it is questionable whether more than 5 per cent of this morbidity occurs among the abstaining class. Investigators who have studied the psychological effects of alcohol on man state that even in moderate quantities it lowers the moral standard, lessens self-restraint, and makes men less cautious. There is a general tendency for alcohol to injure and destroy the higher forms of cell life in the body and to affect the blood and other vital fluids.

Besides, the effect of alcoholic beverages, even in limited quantities, arouses in men the desire for sexual indulgence and association with the demimonde. It can be safely said that every prostitute, professional or otherwise, in some period of her career contracts either syphilis or gonorrhea and hence becomes a menace to her clientelle.

The educated world is rapidly drifting to a high plane of rationalism in the discussion of these great problems and is beginning to discard the maudlin sentiment and prudishness which heretofore have stood as barriers to intelligent action and common sense.

The time has arrived to meet these questions fairly and squarely and without evasion. They must be recognized as a part of the great social fabric, which can not be downed through moral suasion and educational campaigns alone. Legislators, health officials, and authorities generally should be held as responsible for the ravages of venereal diseases in a community as for those of cholera, smallpox, or any other malignant and infectious disease which can be prevented by scientific measures.

In combating the great venereal plague, prostitution should be recognized and subjected to State and municipal laws. The widespread condition of vice diseases in civil life and their degenerating effects on the Nation demand the most drastic measures for the control both of the drinking habit and of prostitution.

In order to accomplish these reforms, no candidate for State or municipal office should be indorsed by the medical profession and

the educated public who had not satisfactorily defined his platform on the control of the three great social evils. A clean and healthy nation should become the war cry of the present generation.

Laws should be enacted in every State, city, town, village, and district throughout the land for the registration, inspection, and segregation of the demimonde. There should be a Yoshiwara in every city, as well as a lock hospital for its diseased inmates. These regulations, if properly enforced, would in a large measure solve the venereal problem.

The experience gained in Jolo during the early days of the Philippine insurrection demonstrated the wisdom of this procedure. At the time Jolo was under military control public women were examined weekly and segregated. Those found diseased were at once transferred to a lock hospital and retained there until they were cured, or until the infectious stage had passed.

The results among the troops were most gratifying, inasmuch as they were practically kept free from these loathsome diseases during the régime, which lasted several years. The men were also regularly examined and kept under quarantine during the infectious stage.

A very satisfactory system was also inaugurated in Manila during the early days of American occupancy, and I believe, with slight modification, is still in force. The public women were required to keep a small examination book, with photograph, and to submit to a weekly examination. Those found diseased were sent to San Lazaro Hospital, which had been especially organized for the courtesan class. The hospital, with a capacity of 300 beds, was practically filled during that period. There were about 1,500 public women in Manila at that time, 25 per cent of whom were constantly suffering from the infectious stage.

All women engaged in the trade of prostitution should be subjected to weekly examinations and required to present themselves to the official examining physician at the prescribed time under a penalty of fine or confinement for noncompliance.

Women physicians could be employed as examiners if the public policy demanded it.

The examinations should be made with the greatest care and none countenanced unless made with the speculum and microscope.

Any woman engaged in illicit traffic as a trade or profession, and found suffering from an infectious venereal disease, should be confined in a lock hospital until she has recovered from the infectious stage.

Laws should be passed making the spread of venereal diseases a criminal offense, and allowing damages to the injured party, in case of legal proof. The penalty should be either fine or imprisonment.

Health boards and public educators should not only educate the masses on the injurious effects of alcoholic addiction and diseases of vice, but should carry this valuable instruction into every public and private school in the land for the benefit of the youth of both sexes.

I know of no period in the history of our country when a general moral reform has been more greatly needed.

The purity of our young men and women is menaced by the vicious tendencies of the age which are destroying public health and morals.

The increase of tippling and cigarette smoking is marked among the women of the wealthy and privileged classes, while their less-favored sisters haunt with pernicious frequency places of amusement which pander to the basest human passions, and chase with utter abandon the voluptuous step of the "grizzly bear," "bunny hug," and "turkey trot."

In the interests of health and morality, dance halls with barroom attachments, restaurants where women resort to drink with men, hotels where young girls are lured to their destruction, music halls that are purveyors of lewdness, and assignation houses should be obliterated from every community.

Barrooms and beer halls should be deprived of the social features which make drinking attractive and dangerous. Music, chairs, tables, and private stalls should be removed, and the accommodations limited to the bar and standing room alone. The treating habit should also be prohibited.

Linked with the general campaign against moral degeneracy and venereal diseases should be laws regulating marriages. No one should be permitted to marry unless recommended by a State board of medical examiners as being free from all morbid and mental conditions which affect heredity. Tuberculosis and constitutional dyscrasias, uncured syphilis, alcoholic and other narcotic addictions, paranoia and allied mental affections, and degeneracy should be disqualifying causes. In order to protect the race, vasectomy should be performed on all male criminals sentenced to prison for murder, robbery, rape, arson, and other crimes of degeneracy.

Our recruiting system is largely responsible for the prevalence of venereal diseases in the Army. Instead of securing recruits from the small towns, villages, and country districts, they are principally drawn from undesirable sections of the large cities. Many of our recruiting stations are located in slum districts and in the vicinity of low bar rooms and saloons, from which they draw a degenerate overflow.

Besides, recruiting parties too frequently are made up of drinking men, who are unable to morally discriminate and do not hesitate to recommend to the recruiting officer applicants who have been sobered up for the occasion.

Maj. Deane C. Howard, Medical Corps, on duty at Jefferson Barracks, states that 50 per cent of the venereal cases treated at that depot were from infections contracted prior to enlistment.[1]

Venereal campaigns in armies and navies should be conducted mainly on lines of weekly inspections and enforced prophylaxis. An exception should be made in the case of married men living with their families and certain noncommissioned officers and high-class privates, who could be trusted with the voluntary use of prophylactic tubes of known efficiency.

Hygienic and moral lectures should be added to the venereal campaign, partly for the purpose of educating the men in sanitation, army and navy diseases, and the ill effects of vicious habits, and partly to elevate their moral standards. The reduction of pay while on sick report from alcoholism and disease of vice, which has recently been made a law, will no doubt become a potent factor in their prevention.

The moral, educating, and Christianizing influences of the Young Men's Christian Association have great weight in the crusade against alcoholic addiction and venereal diseases in military and naval life, and their establishment should be encouraged at every Army post and naval station. Besides, their secretaries are usually interested in athletics, which stimulate morality and temperance.

The club features of the post exchange, if properly developed, contribute largely to the venereal campaign through their entertaining and restraining influences. A pleasant and homelike club for the men, with facilities for the entertainment of their families and friends, would anchor many of the young men who otherwise would seek the excitement of saloon and brothel life on the outside.

The moral influence of fraternity clubs might be put to excellent service in combating venereal diseases and alcoholic addiction in our sister services. I would therefore recommend the organization of a miltary society for the Army and Navy, designated "The National Guardians of Honor."

Its tenets should embrace patriotism, good citizenship, morality, temperance, physical development, and good-fellowship. Organized on military lines, its control should be vested in a commander, vice commander, adjutant, secretary-treasurer, and council. The Government should provide suitable rooms for its meetings and the necessary furniture, heating, and lighting.

At the expiration of his service an honorarium of $100 should be paid every member who had observed total abstinence throughout his term of enlistment. Soldiers are given extra pay for marksmanship, and I know of no factor which promotes greater efficiency in any army than total abstinence.

Since the War Department has officially recognized and enforced venereal inspections and prophylaxis, there is no longer reason for cloaking inspections for this class of diseases under the guise of physical examinations. They should be conducted weekly instead of semimonthly, and, for obvious reasons, before the men have access to the urinal or toilet.

In my opinion, they should also be conducted by an instructed noncommissioned officer of the company, in the presence of the company or detachment commander. This system was in vogue in the central division during the fiscal year ending in June, 1912, and proved very satisfactory.

Noncommissioned officers on duty at recruiting stations become very expert in the detection of diseases and physical blemishes, and I know of no good reason why they should not be utilized as company venereal inspectors. This would relieve medical officers from a routine duty which consumes at present, unnecessarily, much of their valuable time.

It is not necessary to remove more than the blouse and to open the trousers and drawers to make the ordinary venereal inspection. Venereal inspections should not be confounded with physical examinations which require complete stripping in order to prove satisfactory.

In 1906 Maj. H. T. Raymond, of the Medical Corps, now lieutenant colonel, succeeded in introducing the German method of prophylaxis at Columbus Barracks, a recruiting depot notorious for venereal prevalence. The system consisted of a package containing a box of blue ointment, a small vial of 20 per cent argyrol solution, and an ordinary eye dropper in lien of a syringe.

This became known as the K-packet, and its use was voluntary. In a report to the chief surgeon, six months after trial, he was forced to admit that the experiment had but slightly affected the venereal incidence of the post. He attributed its failure to the difficulty of its application, its bulkiness, and its unpopularity among the men for many personal reasons.

In spite of the failure of the K-packet at Columbus Barracks, the system was established in Army posts generally, where it languished and became obsolete in a few years through lack of cooperation, both on the part of the medical officers and the men.

In the meanwhile, naval surgeons introduced aboard ship a dispensary system of disinfection, which has practically become the basis of the system recently established in the United States Army. The routine practice of the Navy, with slight modifications, consisted of (1) a wash of 1–5,000 $HgCl_2$ for the genitalia, (2) 20 per cent argyrol or 2 per cent protargol for urethra, and (3) 25 to 35 per cent HgCl ointment for the penis.

The naval disinfectant system has been used for years with excellent results, in spite of the fact that Post and Nicholl declare argyrol and protargol practically worthless as gonocides.

Passed Asst. Surg. N. J. Zalisky, United States Navy, employed this system aboard ship with most gratifying results. He states that as a result of careful examinations and disinfection, 500 men were protected from venereal diseases for five months without a case of infection. He used 1–1,000 bichloride wash, 2 per cent protargol solution, and 30 per cent calomel ointment. He found that ½ of 1 per cent protargol solution caused urethral distress, and 2 per cent a urethritis.[2]

Surg. R. E. Ledbetter, United States Navy, was also very successful in the treatment of the men under his charge at Cavite, P. I., with this method. He used 1–2,000 bichloride, 10 per cent argyrol, and 33 per cent calomel ointment, and reduced venereal diseases from 30 per cent annually to about 11 per cent.[3]

Maj. Deane C. Howard and Maj. C. F. Morse, Medical Corps, United States Army, at Jefferson Barracks, Mo., and Schofield Barracks, Hawaii, report phenomenally excellent results with the employment of the disinfectant system. Maj. Howard used 1–5,000 bichloride, 20 per cent argyrol, and 20 per cent calomel ointment. Maj. Morse used 1–3,000 bichloride, 1–5,000 permanganate, and 35 per cent calomel ointment.[4]

The same method, with slight modifications, has been largely used by other Army and Navy medical officers with excellent results, though a number of them report failures with men who received disinfection 10 hours after exposure. Maj. Morse reports two failures with gonorrheal infection, one 6 hours after contact, the other 4½ hours after. Other medical officers report 8 hours as the extreme safe period before disinfection.

Besides the enforced dispensary system, a voluntary toilet method has also been used in both Army and Navy. The precautions and disinfectants used in the toilet system were practically the same as those employed in the dispensary method. The results of this system have been unsatisfactory, partly because its application was too complicated for the class of men among whom such diseases usually occur and partly because it was not compulsory.

Early in the spring of 1910 the author began a series of experiments with a view of improvising an effective pocket method in place of the bulky K-packet, which was too complicated for ordinary use and too cumbersome for the pocket.

In conducting these experiments ordinary 4 cubic centimeter collapsible nasal tubes were used for containers. Metchnikoff had proved that 33 per cent HgCl ointment would protect against syphilitic infection, and it was therefore decided to use this ointment as a base for the proposed single-method protection.

A number of different animal, vegetable, and mineral fats were utilized with calomel before a suitable solvent was found. Among them may be mentioned vaseline, coconut butter, olive oil, mutton and beef suet, lard, and lanoline. Since animal fat was found more absorptive on mucous membranes than mineral and vegetable fats, the latter were discarded.

Sixteen men, who were secured as volunteers and divided into groups of two, were utilized in the experiments. Before inoculation, scrapings from their urethras were examined microscopically to guard against existent infection, as well as the pus used in the experiments, to determine the presence of gonococci. The experiments which follow were made in the course of two months, and the results authenticated by the medical officers who conducted them.

The following table gives the formula of prophylaxis used in each experiment, time after inoculation before prophylaxis was introduced into the urethra, and results:

Group formula.	Time after inoculation.	Results.
1. Argyrol, 20 per cent; calomel ointment, 33 per cent	10 minutes	Successful.
2. Protargol, 5 per cent; calomel ointment, 33 per cent	15 minutes	Do.
3. Thymol, 5 per cent; calomel ointment, 33 per cent	20 minutes	Do.
4. Phenol, 3 per cent; calomel ointment, 33 per cent	do	Do.
5. Hyco, 2 per cent; calomel ointment, 33 per cent	25 minutes	Do.
6. Calomel ointment, 33 per cent	do	Do.
7. Calomel ointment, 25 per cent	30 minutes	Do.
8. Calomel ointment, 20 per cent	do	Do.

Dr. Gustavus M. Blech confirmed my experiments in a series of experiments, carried on at Lincoln Hospital, Chicago, Ill., in the fall of 1910. Volunteer Greeks and Italians were utilized for the purpose, and the same technique carried out in regard to urethral examinations and character of pus before inoculation. He used 25 per cent calomel ointment in all his experiments with complete success, which demonstrated beyond doubt the safety of calomel as a prophylaxis against both syphilitic and gonorrheal infection.[5]

Dr. Blech carried his experiments further by operating on a litter of four pups 2 weeks old. Both eyes of each pup were well smeared with gonorrheal pus, after which the right eye of each animal was protected with the 25 per cent calomel ointment and covered with absorbent cotton and bandage. Within three days the unprotected eye became violently inflamed, while the protected eye remained normal.

Several months after the conclusion of my experiments with calomel as a gonococcicide a military tournament was held in Chicago, at which 1,200 Regular troops were present. With the authority and cooperation of the department commander I was enabled to introduce my system in the camp.

The troops were examined physically on arrival and record made of those diseased. They were then furnished the A. & N. Protection, the name given to the calomel tube for convenience and distinction, and instructed in its use. At the conclusion of the tournament, two weeks later, another examination was made of the command, at which no additional cases of venereal diseases were discovered. The formula used during the Chicago tournament consisted of calomel, 30 per cent, and benzoated lard, 70 per cent.

A similar experiment was conducted during the maneuver at Fort Benjamin Harrison in September, 1910. Physical inspections were made of the command on arrival and record made of infected cases. The A. & N. Protection, containing calomel, 30 per cent, and benzoated lard, 70 per cent, was furnished the men. An examination followed the maneuver, and it was found that 594 men, with 1,301 exposures, who had used the protection, suffered no additional infection, while 302 men, with 763 exposures, who had not employed the protection, contracted 26 cases of gonorrhea, 12 cases of chancroids, and 1 case of syphilis.

The A. & N. Protection was officially employed with excellent results at many of the posts in the central division during the fiscal year ending June 30, 1911. The success of any form of venereal prophylaxis depends on the cooperation of both medical and company officers, as well as of the men themselves.

Surg. Reginald B. Henry, United States Navy, calls attention to his success aboard the *Rainbow* with the single calomel method. Through the use of a 25 per cent calomel solution he prevented infection among the crew of the *Rainbow* for six months, with a record of 567 exposures.[6]

Surg. Robert A. Bachmann, United States Navy, speaks very highly of the calomel tube method for gonorrheal prophylaxis. He used the old A. & N. Protection formula, substituting tricresol, 1 per cent, in place of phenol, 3 per cent. He states that nine men had intercourse with a public woman infected with gonorrhea, and escaped infection through the protection of this method. The tube he employs is not as well adapted to the urethra as the A. & N. tube, and, besides, is very much more expensive.[7]

Maj. F. F. Russell and Capt. Henry J. Nichols, Medical Corps, United States Army, Army Medical Museum, instituted a series of "experiments with the A. & N. tube to determine its efficiency as a gonococcicide." In making these experiments they employed 34 men suffering from fresh attacks of gonorrhea.

Their technique was as follows:

Smears were made from the urethral discharge to establish the diagnosis; if the case was suitable, the cultures were made on two to four tubes of ascitic fluid agar. The disinfectant was then applied to the urethra, where it was

retained 1 or 2 minutes, when the excess was allowed to escape; the patient waited 10 to 15 minutes, then urinated, when fresh smears and cultures were made from fluid expressed into the meatus. The cultures were incubated 24 hours, and suspicious colonies examined by a Gram stain.

They state "that the original A. & N. packet we received was effective in seven out of eight cases," which, I think, is a most favorable showing, when we consider the rigid test to which the method was subjected.

In the conclusions of their report they state that "the original A. & N. packet is effective as a prophylactic, probably on account of its content of carbolic acid, which is brought into action by the camphor and lard." The successful A. & N. formula used by Maj. Russell and Capt. Nichols consisted of camphor, 3 per cent; phenol, 3 per cent; calomel, 25 per cent; lanoline, 25 per cent, and rendered lard sufficient to make 100 parts.

Since the inauguration of compulsory hospital or dispensary disinfection by the War Department, the following details of the system have been furnished from the Surgeon General's Office: 1. Entire name, rank, and organization of soldier, with day and hour of contact, and day and hour of disinfection. 2. Wash genital organs with soap and warm water. 3. Inject into urethra 4 cubic centimeter solution, composed of protargol, 2 per cent; glycerin, 15 parts, and water, 85 parts. Retain three minutes. 4. Rub entire penis in calomel ointment, 30 per cent, and wrap in soft paper napkin.

The Surgeon General authorizes the use of a 20 per cent argyrol solution, in case the protargol produces an irritating effect on the urethra, and has recommended the sale in post exchanges of protective tubes containing the formula of the A. & N. Protection as given above in Russell and Nichols's experiments.

The above dispensary system has proved satisfactory in the Navy in those cases where the disinfection has been administered from six to eight hours after exposure.

A combination of the dispensary method with the prophylactic tube should prove ideal in those cases where the men remain absent more than five or six hours after sexual contact. Without disinfection or the use of prophylactic tubes within that period, it is generally believed that less than 50 per cent of the men will be protected.

[1] Military Surgeon, December, 1911.
[2] United States Naval Bulletin, January, 1912.
[3] Journal American Medical Association, Apr. 15, 1911.
[4] Military Surgeon, December, 1911, and September, 1910.
[5] American Journal of Dermatology, No. 8, 1911.
[6] Military Surgeon, May, 1912.
[7] Idem, August, 1912.

VENEREAL PROPHYLAXIS IN THE UNITED STATES NAVY.

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The year 1908 marks the beginning of the period when the venereal question in the United States Navy began to be seriously considered.

For several years efforts had been made by medical officers to lessen the incidence of venereal diseases, but until recently these were desultory in character and spasmodic in application. Quarantining the venereally infected—that is, detaining them on board ship or in hospital until they were no longer likely to communicate the disease to others—was commonly resorted to. Beginning 12 or 15 years ago, lectures were given to the enlisted men showing what venereal diseases were, how they were contracted, and what effects they had on the individuals infected with them. These lectures were particularly addressed to the apprentices and the other young enlisted men. No medicinal prophylaxis was then systematically employed. One heard now and then of the precautionary use of bichloride of mercury or permanganate of potash. I am inclined to believe that the lectures inspired no other result than a spirit of bravado among the many devotees who haunted the shrines of Aphrodite. Venereal diseases have always received due professional care, but the tabulation of data for statistical purposes was regarded with indifference, or, at best, was incomplete. The Navy was smaller; the accuracy of its being had not attained the high degree that had its origin in and has continued since the Spanish war. The constant striving for fitness and efficiency led to a careful examination of every feature of naval life, and venereal diseases came under close scrutiny.

In all probability, too, the question attained an important place in the minds of medical officers because of like efforts made in civil life. Much had been written regarding the suppression of venereal diseases, and organized crusades like that against tuberculosis had been preached, both in civil and military life. And likewise some inspiration was felt from the propaganda of the so-called moral prophylaxis societies.

The discovery of the treponema pallida in 1905, and its susceptibility to certain drugs, led naval medical officers to make more systematic and definite efforts at suppressing venereal diseases. In 1906 there was an organized effort on some of the ships of the Navy to lessen the prevalence of venereal diseases by the authoritative control of men and the use of drugs. The data made of these efforts appear to show some success. The methods employed were essentially those since adopted and now in force throughout the service.

Early in November, 1909, Medical Director Diehl urged its adoption in our Navy. He secured official approval of the commander in

chief of the Asiatic Station, and the results that immediately followed were regarded as successful. Dr. Diehl's paper was published in the Naval Medical Bulletin in 1910. In May of that year, at the instigation of Medical Inspector A. M. D. McCormick, United States Navy, then fleet surgeon, Dr. Diehl's method was adopted in the Atlantic Fleet. It formed the subject of a circular letter issued to the fleet by the commander in chief, Rear Admiral Seaton Schroeder. That circular letter, with some modifications, is still in force. Its last formal issuance was made on January 12, 1912, by Rear Admiral H. Osterhaus, United States Navy, the present commander in chief. The substance of its instructions are as follows:

Men are instructed as to the nature of venereal diseases, and emphasis laid on the fact that indulgence is not necessary for their health, as many believe it to be. The effect and value of prophylaxis is explained, and it is pointed out that those who have been exposed may secure probable immunity by immediately reporting at the sick bay and taking the treatment which is provided, and, furthermore, that those who do not avail themselves of this care, and who develop a venereal disease, are liable to disciplinary action in the same way as if their services had been lost for the like period of time through drunkenness or any other misconduct.

Every case of venereal disease occurring is admitted to the sick list, and continued for at least one day, so that it may appear on the morning sick report.

Special report is made to the commanding officer of such venereal cases as have not protected themselves by taking the treatment; and disciplinary action may be taken in all such cases.

All instances of concealment of venereal disease or treatment thereof by improper means are reported to the commanding officer in accordance.

All medical officers are required to make monthly reports in a prescribed manner, indicating the number of men going on liberty, the number admitting exposure, the number of primary admissions both among those admitting exposure and those who have not admitted exposure, and a statement of the incidence for syphilis, chancroid, and gonorrhea. A summary of these monthly reports is made for each year and embodied in the annual sanitary report of each ship and station.

Theoretically, the plan is an excellent one, and at first sight promising. In actual application it is open to many disturbing factors. On the medical side, the efficiency of drugs and the accuracy and timeliness of their application may lead to doubt. In the man himself, the quality of his sexual morality and his willingness to submit to treatment will give rise to error. Some medical officers, in spite of the best intentions, will temporarily weary in well doing; men prompted by sexual appetites will display unexpected vagaries; and official pronouncements, unless frequently renewed, are liable to become a dead letter in a short time. For these reasons the statistics thus far sent in are disappointing. Some officers are convinced they show a lessening of the incidence of syphilis. Venereal prophylaxis has been officially in force in the Atlantic fleet since May, 1910. It still partakes largely of the nature of an experiment. Its value can

be determined only by a continuance for another two years, so that the results of any one year may be compared with at least three others.

Beginning with 1908, the statistical reports of the Navy show a striking increase in the venereal diseases. Some explanation is proper to show that the sudden increase was more apparent than real.

Prior to 1908 the method of keeping statistical records of venereal diseases was less accurate than the method used since that time.

A considerable number of cases did not present themselves to the medical officers for treatment, the men concealing their condition in order to escape being placed on the quarantine list, and these, of course, did not appear in statistical reports. Many cases which came to the attention of the medical officers were of a character which did not incapacitate for duty. As was the custom at the time, they became subjects for medical treatment, but not for statistical record.

Beginning with 1908, in accordance with official instruction, the keeping of the venereal statistical records became more comprehensive and accurate. Any man suffering from a venereal disease was required to report his condition to his medical officer. Concealments, when discovered, were punished. Every venereal case coming under the cognizance of the medical officer was made a matter of record. Every case of illness which was the sequel of a venereal disease, and came to the attention of the medical officer, was likewise made a matter of record; the diagnosis which was entered being not of illness at the time of presentation, but of the original venereal disease that gave rise to that illness.

Because of these circumstances, it will be readily seen why, within the period of a year, the number of primary admissions and the number of sick days for venereal diseases suddenly increased. The figures indicate greater care in preparing the statistics rather than an actual increase in the pro rata incidence of venereal diseases.

The belief is widely prevalent in civil life that the rate of venereal disease is higher in the Navy, generally speaking, than in civil life. It is this belief which helps to form the unfavorable prejudice which the average civilian entertains against the enlisted man. In my studies of this subject I also find, and to my amazement, that many naval officers believe the same. The statement is inaccurate. On the contrary, the incidence of venereal diseases in the Navy is no greater, and perhaps even less, than in civil life; or at its maximum it is no greater than in the average civil community among men of the same age, as I shall endeavor, briefly, to show.

In the first place, it is starting with an error to assume that the enlisted personnel of the Navy differs in its human attributes from the rest of humanity. It is true that at times the incidental things of life in the service, such as environment, and the sudden and free relaxation from periods of restraint, tend toward incontinence in

sexual matters and their pathological consequences. But for every one of these that can be named, in connection with the sailorman's life, there could be mentioned an equivalent occurring in the life of the civilian. It might further be said that the sailorman has the advantage, in that he has a different training in cleanliness, good behavior, and self reliance, and, although not always lived up to, his standards of decency are high.

The enlisted man is a picked man. At the time of his enlistment the medical examiner determines his freedom from venereal diseases or their consequences. In passing it might be mentioned here that a considerable percentage of candidates presenting themselves for enlistment are rejected because of the presence of venereal disease.

When the man of the Navy contracts venereal disease, the sources from which he received his infection are in civil life and not in the Navy. His disease comes from the lewd woman and her haunts, maintained in civil life, and these are patronized as much by the civilian as by the sailor, if not more. The sailor both contributes to and receives of the moral and physical confusion on shore, but no more than his civilian brother; their degree of indulgence is prompted by an instinct common to both; their measure of troubles is gathered from the same field.

In the Navy the military methods are such that every feature of a man's career is under constant surveillance, and the greater part of it becomes, in some form, a matter of record. As I have shown, we measure, to a close degree of accuracy, the prevalence of venereal diseases. We know that these diseases exist in the service to an extent that is startling as to morals and distressing as regards efficiency. We classify them, tabulate them, and determine their various ratios, and then published them broadcast for anyone to read. The purist, hearing of our labors, points with the finger of scorn at the sailorman and hastily condemns him as rough and a licentious person, unworthy to associate with the supposedly more continent civilian.

Unfortunately, no accurate statistics are kept in civil life which indicate either the degree of sexual immorality or the prevalence of venereal disease. A case of venereal disease is usually known only to the sufferer himself and the medical man to whom he goes for relief. Between the two the utmost secrecy concerning the fact is maintained, one being governed by fear of public opinion, the other by a recognized professional obligation. No records are kept, no statistics are prepared; nothing is publicly known. Of recent years this side of the question has been carefully studied, and current professional literature gives abundant information.

In studying the question of venereal diseases it must be kept in mind that primarily we are dealing with a sexual instinct, a subject that has teased and pestered humanity from the founding of the

Garden of Eden to the present moment; a subject which has defeated the ingenuity of the wisest of men, and of which any conclusive solution seems remote to-day. Some of the orders of insects, either through an original plan of nature or an acquired adjustment to environment, have disposed of the sexual instinct in a manner that fills us troubled humans with wonderment.

It has been said that it has become possible, by coordinated effort, to rid mankind of all infectious diseases. And so it is; but, unless some great panacea is discovered to help us, venereal diseases will be the last to survive. The war against tuberculosis is a comparatively easy one, because the inception of the disease is in the ordinary every-day environment, and its immediate consequences are sickness and death. It has no association with a dominant and instinctive craving, in the gratification of which the victim is blind to consequences.

The medical man of the Navy naturally takes his largest view of the venereal problem on the side of utility and human efficiency; the philanthropist, on that of eugenics; the religious, on that of morals. No one questions the propriety of employing all three. We of the Navy have, for obvious reasons, devoted our strongest efforts in the direction of efficiency as it is attained by the employment of military authority and the use of drugs. We have not neglected the other sides. No doubt they might have been preached with greater emphasis.

A study of this subject based on statistics is not within the intention of this paper. That has been treated of voluminously by several medical officers. Statistics, as kept in the Atlantic Fleet, covering approximately 20,000 men and more than 20 ships, reveal nothing definite as to results. The best they show is a concerted and determined effort in the endeavor to solve the problem.

To the medical man the great desideratum is a positive specific remedy for each of the three phases of venereal display. Until they are discovered, the problem, as now studied, is a complex and puzzling one. Without such specifics, I am of opinion that the effort as now made, however comprehensively and faithfully applied, is futile. The involved questions of morals, decency, and continence, to be applied for practical results in the world at large, are Utopian.

The best that I can garner from the work in the Navy is the existence of a great need to eliminate venereal diseases and an enthusiastic effort toward that end. Out of this display of energy there may emerge, perhaps, the specific remedies.

VENEREAL PROPHYLAXIS IN ARMIES.

Maj. Deane C. Howard, Medical Corps, United States Army.

No present-day problem in military preventive medicine is of greater importance in relation to the physical efficiency of armies than that of effectual control of venereal diseases. This is especially the overshadowing problem in the United States Army, which now has the unenviable distinction of leading the armies of the world in venereal prevalence. This excessive prevalence in our Army is probably more apparent than real, as safe deductions can not be drawn from a comparison of published venereal statistics unless it is known that all cases of venereal disease are uniformly made of official record in all armies, and that no concealed cases exist. The true incidence of these diseases can be known only through periodical physical inspection of all troops. These conditions do not now obtain, hence comparisons of published venereal statistics in various armies are of little value. However, it is probably true that the actual incidence of these diseases in the United States Army has been greater in recent years than in most, if not all, continental armies. The more general application of approved methods of personal disinfection, following coitus, under official sanction and direction, as well as more or less effective regulation and sanitary control of prostitution, are the factors probably responsible for the lesser incidence abroad. Venereal diseases in armies, while not entirely eradicable, are in great part preventable. The specific causes, the exact methods of transmission, and the sources of infection are known, hence the accepted principles of scientific preventive medicine should, so far as possible, be applied for their control. Unfortunately, prophylactic measures of known efficacy may be possible of application in some armies, but not in others. The problem is therefore a special one for each army concerned. In the United States Army whatever effective measures we are able to apply are those directed chiefly to the individual soldier. The sources of infection are beyond military control, and we can hope for no effective regulation and sanitary supervision of prostitution by the civil authorities in view of a public sentiment in the United States which is unalterably opposed to any form of official recognition. Being generally inapplicable in our Army at present, these measures will not be discussed here.

The increasing prevalence of venereal diseases in the United States Army during recent years has been the occasion of great concern on the part of its medical authorities. Measures have from time to time been recommended by the Surgeon General of the Army, which, if universally and rigidly enforced, would have caused a marked reduction in our venereal rates. Concerning this question, the policy of

the higher military authorities in the War Department was for many years one of silence and inaction. The issuance of military orders directing inspections of troops for venereal disease, the use of prophylactic solutions following intercourse, or any other preventive measures were opposed, as it was held that "the publication of such orders may prove offensive to the general public and humiliating to the service." This attitude, and the consequent failure to put uniform and effective measures of prophylaxis in force throughout the Army, have been the chief causes of our continuously high venereal incidence. So long as effective prophylaxis depended on the individual initiative of medical officers, without the direction and support of high military authority, results were disappointing. It is to the great credit of the present administration of the Surgeon General's Office that the War Department has been convinced of the necessity of meeting the venereal issue fairly and squarely, thus reversing a previous long-established policy. General Order No. 17, May 31, 1912, directs, throughout the Army, bimonthly inspections of troops for the detection of venereal disease, an official record to be made of all known cases, and the application of individual prophylactic treatment following exposure, under penalty of trial by court-martial for noncompliance therewith. It is certain that reduced venereal rates will result from the general enforcement of the provisions of this order. It may be possible, however, that for a time venereal admissions may show an actual increase, as heretofore periodical physical inspections for concealed cases of disease have been by no means universal, and many known cases of disease have not been appearing of record.

Measures of prophylaxis of proved worth, which are applicable in our Army, will be discussed briefly.

1. EDUCATIONAL AND MORAL PROPHYLAXIS.

The subjects of sexual hygiene, the venereal diseases, and the social evil are now discussed from public platforms and in the press with a frankness that would not have been tolerated by public sentiment a decade ago. The public is thus being enlightened concerning the wide prevalence and frightful ravages of venereal diseases. It is believed that the fuller discussion and comprehension of the venereal peril has been productive of much good and may ultimately result in the application of straightforward, sane measures for the control of these diseases in civil communities. Indirectly this will benefit the Army, for the soldier does not contract venereal disease in barracks but from the prostitute in civil communities, who is at present permitted to disseminate infection without restriction. Coincidently these subjects have in recent years been given increased

prominence in the Army. Instruction has been offered quite generally through lectures by medical officers and distribution of venereal circulars made to the individual soldier. This has been supplemented by informal advice to the men as opportunity offered, and moral talks by chaplains and others. Educational and moral measures are desirable and of some value, but alone will have little influence on venereal prevalence in armies. Soldiers can not be made celibates by order or by well-intended advice. The great majority will deliberately expose themselves to venereal diseases with full knowledge of the dangers of infection and of the seriousness of the diseases to which they are exposed. Comparatively few will practice continence on the advice of the highest medical or other authorities.

2. RECREATIVE FEATURES AND ATHLETICS.

Idleness is said to be "the mother of lechery," and consequently must bear a certain relationship to the prevalence of venereal diseases. Wholesome amusements in garrison, the encouragement of athletics and of out-of-door sports, are of undoubted value. The athlete who takes pride in his physical supremacy is rarely a sensualist. Well-equipped recreation and reading rooms, gymnasia, and soldiers' clubs should be provided and made so attractive that the soldier will be inclined to spend his spare hours in garrison, thus avoiding the temptations of the disreputable haunts of diseased women.

3. INSPECTIONS.

Frequent physical inspections of all soldiers for concealed cases of disease are absolutely essential as a part of any effective scheme of prophylaxis. Inspections should be held bimonthly, without previous notice to the men, and preferably immediately following a formation. Soldiers submit to these inspections as a matter of course, and where the practice is in force usually report the appearance of disease promptly, anticipating detection at the regular inspection. Every known case of venereal disease should be made a matter of official record. Venereal disease in barracks is a menace to innocent comrades, and in armies such cases should be treated in hospital during the stages of infectivity.

4. LENGTH OF TREATMENT.

Prolonged observation and treatment of venereal cases are important factors in prophylaxis. Readmissions of syphilitics, which are due most often to neglected or interrupted treatment, should be comparatively infrequent. A syphilitic register, in our service, follows the soldier from station to station and insures intelligent and

regular treatment of syphilitics as long as it is required. Gonnorrhea patients, even when apparently cured, as evidenced by negative microscopical findings and cessation of discharge, should be kept in semiquarantine, with restriction of all pass privileges, and under frequent observation for several weeks after return to duty to prevent opportunity for reexposure and probable relapse before the cure is complete.

5. PERSONAL PROPHYLAXIS.

Fully 80 per cent of venereal infections in men are preventable if proper prophylactic treatment is given within 10 hours following exposure. Personal prophylaxis is of greater value than all other preventive measures combined. Any effective scheme of prophylaxis in the Army must provide and insure that proper treatment be given at the proper time and in the proper manner. The failure in the trials of personal prophylaxis in our Army, through "K" and other packets distributed to the soldier, and company lavatory disinfection systems, has been due chiefly to the fact that, through ignorance, indifference, carelessness, or drunkenness, the majority of soldiers failed to carry out properly the treatment provided. The treatment should be given in a secluded room at the hospital, and only by, or under the immediate supervision of, a trained hospital attendant. To secure protection to every soldier exposed, the treatment must be mandatory by military order, and not dependent on the whim of the soldier.

6. PUNITIVE MEASURES.

Mandatory prophylaxis must be rigidly enforced by certain punitive measures. It is important that every soldier who contracts venereal disease, and has failed to use preventive treatment at the proper time, should be punished by trial by court-martial. The penalty for delinquency should be sufficiently heavy to insure general compliance with the order. No guilty man should escape. Under this system, a stigma attaches to the soldier who contracts venereal disease. Pass and other privileges should be forfeited, not only while under treatment for the disease but for a definite period afterwards. We can not prevent soldiers from exposing themselves to these diseases, but we can and do protect them against themselves by mandatory prophylaxis. After exposure, and not before, are soldiers inclined to consider possible consequences, and they are then more amenable to orders requiring them to take precautions to avoid disease.

If best results are to be obtained, the responsible officer in every command must personally investigate each venereal admission, to determine whether or not the orders on the subject have been strictly

complied with. The unconfirmed statement of the soldier as to the date of his exposure is of little value, as, in case he has failed to take preventive treatment at the proper time, he is naturally anxious to avoid the penalty for his negligence, and his statement is colored accordingly. Chief reliance must be placed on the known period of incubation of these diseases. Cases showing an unusually long incubation will be viewed with suspicion. Many schemes are devised by soldiers to avoid punishment for failure to comply with orders on the subject, and in some cases the guilty undoubtedly escape. Constant vigilance is necessary to keep these cases at a minimum.

7. STOPPAGE OF PAY.

Under the terms of a soldier's enlistment contract, he enters the service presumably with a sound body. A moral obligation devolves on him to maintain his health and thus render full service during the period of his enlistment. He fails in this obligation when, through his own misconduct, he becomes incapable of performing his duty. Therefore, it is but just and equitable that, during the time he is physically incapacitated on account of venereal disease, his pay and allowances should be forfeited. Recently this provision has been enacted into law, through the urgent recommendation of the Surgeon General of our Army, supported by the higher military authorities. Its enactment will result in automatic punishment for every offender. Soldiers should now be as much concerned individually to protect themselves from disease as we heretofore have been concerned to protect them. As a result of this new law, a more general compliance with orders requiring personal prophylaxis following exposure appears certain.

A system of venereal prophylaxis, the essential of which is mandatory personal disinfection following exposure, was initiated at Jefferson Barracks, Mo., August 1, 1911, and has since been in successful operation. Jefferson Barracks is one of the larger recruit depots, and has a continually changing personnel. Nearly 10,000 recruits pass through the depot during the year. Conditions are therefore more difficult, for effective prophylaxis, than in regular garrisons where the personnel is comparatively permanent. A great majority of admissions for venereal disease at Jefferson Barracks during the past year have been due to infections contracted prior to enlistment. Obviously, our prophylactic measures can have no control over this class of admissions. The scheme of prophylaxis includes educational, moral, and recreative features, prolonged observation and treatment of venereal cases to prevent relapse, and bimonthly physical inspections of the command for venereal disease. Chief reliance, however, is placed on mandatory personal prophylaxis

in conjunction with certain punitive measures, i. e., restriction of privileges, prolonged quarantine, and trial by court-martial of every soldier contracting venereal disease who has failed to report for the prophylactic treatment at the proper time. Every recruit, within 48 hours of his enlistment, receives personal instruction concerning venereal diseases from his squad instructor. The text of the post order on the subject is read and explained to him. This includes a brief description of the venereal diseases, the mode of transmission, and the dangers of cohabitation with prostitutes. Sexual continence is advised as compatible with full mental and physical vigor, and as the only "sure way to escape venereal diseases." To those who will not heed the advice as to sexual continence, it is explained that a system of treatment has been prescribed, and is given by a trained hospital attendant to every soldier, following exposure, immediately upon his return to post and that the earlier after intercourse he reports the better are his chances to escape infection. Within 10 days of the recruit's enlistment he receives further instruction along the same lines from a lecture by a medical officer. When a recruit has received this instruction from his squad leader it is so recorded by the insertion of the letter "V" on his individual instruction report. A copy of the order on the subject is kept conspicuously posted on all bulletin boards. Paragraph 3 of the order reads:

> All enlisted men of the command who expose themselves to the danger of contracting venereal disease by sexual intercourse with women will, immediately upon return to the post, or if exposed on the reservation before return to quarters, report at the hospital for preventive treatment.

The treatement consists in (1) thorough cleansing of genitals, using 1–5000 mercuric chloride solution (2) injection into the anterior urethra of 4 cubic centimeters of 20 per cent argyrol solution; (3) the application to the entire penis of 2 to 4 grams of 30 per cent calomel ointment, especial attention being given to the glans and prepuce. The hospital attendant on duty in the venereal dressing room keeps an accurate record of each treatment in the prophylactic register provided for the purpose. The record shows the name and organization of the soldier, the hour and date of exposure, and the hour and date treatment is given. Under remarks may be noted that the soldier was "intoxicated," or any other information bearing on the case. When a case of venereal disease is noticed we ascertain whether or not the soldier has reported for treatment as required. If not, he is reported by letter to the adjutant for disciplinary action, the medical officer furnishing the necessary evidence in the case. The relationship between the hour and date of exposure and the hour and date when treatment is given, as shown on the prophylactic record book, is important in the determination of delinquency. The soldier who reports for treatment several hours after return to post

(giving various excuses for his delay) is held to be equally culpable with the soldier who fails altogether to take the treatment. The order requires him to report immediately (regardless of other duty) and he is held strictly to this requirement. Every delinquent has been punished. There have been no concealed cases of disease and every case has been taken up and made of official record.

RESULTS.

With a venereal admission rate of 174 per 1,000 for the entire Army, in 1910, the rate for Jefferson Barracks was 318 per 1,000. For the year immediately preceding the initiation of mandatory prophylaxis, the venereal admission rate was 290 per 1,000. During a part of this latter period, voluntary prophylaxis was in force. These excessive rates, as compared with the Army at large, were due in great part to the large number of infections contracted before enlistment. It is impossible, under present regulations governing examination of applicants, to avoid the enlistment of men while they are in the incubation period of the disease, and venereal rates at recruit depots suffer accordingly. During both periods, for which rates are quoted, no physical inspections of command for the detection of venereal disease were made, except the regular outgoing examinations of recruits. In August, 1911, regular venereal inspections were first authorized, and have since been made, at first monthly and later bimonthly. Under these conditions, if prophylactic measures had not been in force, a rate considerably higher than in 1910 would be expected. That prophylaxis has been effective is shown by the reduced admission rate of 154 per 1,000 for the year ending August 31, 1912, a reduction of 47 per cent from the rate for the preceding year, and 52 per cent from 1910. This reduction has been effected entirely in the class of new cases or fresh infections. Careful records have been kept in each venereal admission, and it is shown that 59 per cent of total admissions during the year have been from infections contracted before enlistment, before arrival at station, or readmissions of old cases.

This class of admissions, representing an admission rate of 91 per 1,000, obviously is beyond control by prophylactic measures at the depot. It is reasonable to assume that admissions of this class were equally numerous in 1910. Deducting from the total admission rate for 1910, the assumed rate for this class of infections, there remains a rate of 227 per 1,000, which may be considered a fairly correct estimate of the admission rate for fresh infections contracted at the depot in 1910. For the year ending August 31, 1912, the fresh infections contracted at the depot represent an admission rate of only 63 per 1,000, a reduction of 72 per cent from the assumed rate

for 1910. There were 84 fresh infections contracted at the depot during the year, with an average enlisted strength of 1,329. Of the above, 60 had failed to use prophylactic treatment (delinquents), while only 24 infections developed following the use of the prophylactic in 3,800 treatments, or one infection to every 158 men exposed and treated. (To this record may be added 275 treatments, with 3 infections, from June to August, 1911, before the treatment became mandatory, which gives a total of 4,075 treatments, followed by 27 infections, the complete prophylactic record at the depot.) If every soldier had taken the treatment, as required by orders, it is believed that the admission rate for new cases would not have exceeded 25 per 1,000. This latter rate, then, we may hope to attain in commands having a more or less permanent personnel, by reducing delinquency to a minimum through heavier penalties.

The following table shows the venereal incidence and prophylactic record by months:

Venereal record at Jefferson Barracks, Mo., with results of mandatory individual prophylaxis from Sept. 1, 1911, to Aug. 31, 1912.

Month.	Average enlisted strength of command.	Total venereal admissions.	Contracted before enlistment or before arrival at depot or readmission of old cases.	New cases (fresh infection) contracted at depot.	Reported for prophylactic.		Total number prophylactic treatments.
					Yes.	No.	
1911.							
September	1,439	21	17	4	1	3	216
October	1,288	23	15	8	2	6	256
November	1,419	19	11	8	2	6	248
December	1,479	29	15	14	7	7	376
1912.							
January	1,475	13	10	3	2	1	334
February	1,371	12	6	6	1	5	245
March	1,445	15	5	10	2	8	371
April	1,476	18	11	7	2	5	544
May	1,337	13	6	7	3	4	402
June	1,128	19	11	8	.....	8	288
July	1,086	10	6	4	1	3	262
August	1,091	13	8	5	1	4	258
Total	.....	205	121	84	24	60	3,800

SUMMARY FOR THE YEAR.

Average daily enlisted strength	1,329
Admission rate per 1,000 for venereal diseases (total)	154
Admission rate per 1,000 for venereal diseases contracted before enlistment, before arrival at post, or readmission of old cases	91
Admission rate per 1,000 for venereal diseases contracted at depot (fresh cases)	63
Admission rate per 1,000 for venereal diseases (fresh cases) developing after the use of prophylactic	18
Admission rate per 1,000 for venereal diseases (fresh cases), in which the prophylactic was not used (representing delinquency)	45
Degree of protection afforded by prophylactic treatment—one infection to every 158 treatments—per cent	99.3

Of the 24 infections in which the use of the prophylactic failed to prevent disease 16 were gonorrhea, 7 chancroids, and 1 syphilis. The relative degree of protection afforded by the treatment for the 3 venereal diseases as shown by this series of cases follows: Gonorrhea, 1 infection to 237 treatments; chancroids, 1 infection to 542 treatments; syphilis, 1 infection to 3,800 treatments.

The detailed cases appear in the following table:

Data concerning 24 cases of venereal disease credited as failures of prophylactic treatment, Jefferson Barracks, Mo., Sept. 1, 1911, to Aug. 31, 1912.

Case number.	Date of exposure (soldier's statement).	Number of hours between exposure and use of prophylactic.	Incubation period (days).	Disease.	Complications.	Number of days under treatment.	Remarks.
I. C. S., recruit Twenty-third Company.	Aug. 6,1911	3½	22	Chancroids..	Chancroidal adenitis.	15	Undoubtedly exposed at a date later than alleged. Probably a delinquent.
II. J. K., recruit Twenty-third Company.	Oct. 1,1911	3	2	Acute gonorrhea.	None.....	14	Previous attack of gonorrhea 1 year ago.
III. F. W., recruit Twenty-third Company	Oct. 11,1911	4	9	.....do.....	.....do.....	16	Protargol (2 per cent) used as urethral disinfectant.
IV. D. H. M., recruit Fifteenth Company.	Nov. 9,1911	3½	5	.....do.....	.....do.....	48	Drunk when prophylactic used.
V. W. S., recruit Fifteenth Company.	.....do.....	9	10	.....do.....	.....do.....	33	Incubation 10 days (?); probably a delinquent.
VI. H. J. G., recruit Twenty-seventh Company.	Dec. 9,1911	7	4	Multiple chancroids	Acute gonorrhea and stricture.	64	Third attack.
VII. W. S. C., recruit Fifteenth Company.	Dec. 10,1911	6	4	Acute gonorrhea.	None.....	20	
VIII. J. E. P., recruit Fifteenth Company.	.....do.....	6	5	.....do.....	.....do.....	34	
IX. W. V., recruit Twenty-seventh Company.	Dec. 11,1911	5½	4	.....do.....	.....do.....	24	
X. T. D. D., recruit Twenty-seventh company.	Dec. 10,1911	10½	6	.....do.....	.....do.....	36	
XI. E. F. H., recruit Twenty-seventh Company.	Dec. 11,1911	9½	6	.....do.....	.....do.....	38	Argyrol.
XII. J. C. F., recruit Twenty-third Company.	Dec. 9,1911	5	20	Chancroids, multiple.	.....do.....	10	20 (?) days incubation; undoubtedly exposed at a later date and exposure denied.
XIII. F. B. S., recruit Eighteenth Company.	Dec. 23,1911	4	10	.....do.....	Suppurative adenitis chancroidal	55	Probably a delinquent.
XIV. A. O., recruit Eighteenth Company.	Jan. 11,1912	4½	5	Acute gonorrhea.	Periurethral abscess.	22	

Data concerning 24 cases of venereal disease credited as failures of prophylactic treatment, Jefferson Barracks, Mo., etc.—Continued.

Case number.	Date of exposure (soldier's statement).	Number of hours between exposure and use of prophylactic.	Incubation period (days).	Disease.	Complications.	Number of days under treatment.	Remarks.
XV. H. D., recruit Twenty-seventh Company.	Feb. 14, 1912	1	8	Acute gonorrhea.	None.....	22	On pass Feb. 10, which is probable date of exposure, though denied. Probably reported for treatment when disease appeared.
XVI. T. J. D., recruit Sixteenth Company.	Feb. 10, 1912	3½	39	Primary syphilis.	.....do.....	19	Long incubation period suggests subsequent exposure, when no prophylactic was used.
XVII. A.J.P., recruit Twenty-seventh Company.	Mar. 12, 1912	9	9	Acute gonorrhea.	.....do.....	28	Long incubation period suggests probable subsequent exposure and failure to use prophylactic.
XVIII. J. M.W., musician Fifteenth Company.	Apr. 15, 1912	3	3	.....do.....	Gonorrheal arthritis.	11	
XIX. E. B., recruit Fifteenth Company.	Apr. 11, 1912	5½	10	.....do.....	None.....	10	Long incubation period suggests a later exposure than alleged and probable delinquency.
XX. S. W. H., recruit Eighteenth Company.	May 18, 1912	5½	1	Chancroids, multiple.	.....do.....	38	
XXI. C. D., recruit Sixteenth Company.	May 16, 1912	4	4	Chancroids (phagedenic).	.....do.....	54	
XXII. L. T., recruit Eighteenth Company.	May 13, 1912 May 21, 1912	2 2½	9	Chancroids, multiple.	....do.....	53	Had a laceration of penis following coitus, May 21. Ulcers developed at site of laceration.
XXIII. V. D., private Hospital Corps.	July 14, 1912	3	3	Acute gonorrhea.	Gonorrheal epididymitis.	29	
XXIV. M. T. L., recruit Eighteenth Company.	Aug. 13, 1912	2½	3	.....do.....	None.....	.....	

Several of the cases recorded above undoubtedly were delinquents, but the evidence was not sufficient to justify other classification, and they were given the benefit of the doubt. The prolonged incubation period in some cases suggests the possibility that the use of the urethral disinfectant may retard the development of the disease in the cases in which the disease is not prevented. The average period

of treatment for uncomplicated cases of gonorrhea developing after the use of the prophplactic does not appear to differ materially from that of cases developing without prophylactic treatment, the average being 27 days for 13 such cases.

In the success that has attended mandatory personal prophylaxis at Jefferson Barracks, Mo., during the past year, no great insistence is placed on the particular urethral disinfectant employed. It is the system alone that is most essential. Argyrol in 20 per cent solution has been used almost exclusively, and while its value as a gonococcicide appears to have scant laboratory support, the clinical proof of its efficacy for prophylactic purposes is ample, as demonstrated by this series of cases. It is probably the most efficient gonococcicide among all nonirritating silver preparations, and has proved eminently satisfactory in our work. The value of calomel ointment as a preventive of syphilitic infection has been accepted universally for many years, following the reports of Metchnikoff's convincing experiments on apes. No other preparation has been seriously considered as a substitute for it in prophylactic work. Recent reports have indicated that calomel (30 per cent), combined with a member of the phenol group, and made into a paste with animal fat as a menstrum, protects equally well against both gonorrhea and syphilis. For routine use in the Army a single preparation, instead of two, obviously is highly desirable. The older and well-tried disinfectants in prophylactic work, however, should not be displaced hastily by the newer preparation until the worth of the latter as a gonococcicide has been fully established by ample clinical experience.

While the system described imposes more labor on the medical and hospital personnel than other systems of prophylaxis, the additional labor is more than justified by the better results obtained. In regular garrisons, where prior to enlistment infections are rare as compared with recruit depots, the success of mandatory prophylaxis should be more strikingly evident. The system is entirely practicable, as demonstrated by a full year's experience with it at Jefferson Barracks. An order requiring soldiers to report for disinfection following exposure is enforced as easily as orders on any other sanitary subject. Some delinquency may be expected, but this must be kept at a minimum by the imposition of heavy penalties in each case of failure to comply with the order. Under the provisions of General Order No. 17, War Department, 1912, mandatory individual prophylaxis is now in force throughout the United States Army. The order referred to is properly general in its terms, and does not dictate the details necessary to be followed for each command. While it is directed that the "hospital" system of disinfection be applied in all commands, provision should be made also for the distribution and use of packets in conjunction with the above, where commands are not reasonably

near the communities harboring the sources of infection. To secure effective prevention, treatment should be applied within 10 hours following exposure. When soldiers are absent from their commands for periods longer than 10 hours, individual treatment should be applied by the soldier himself immediately following coitus, to be followed by a second disinfection upon return to his post.

In conclusion, individual prophylaxis enforced by military order, in conjunction with punitive measures and automatic stoppage of pay and allowances for the period actually incapacitated on account of venereal disease, tending to reduce delinquency to a minimum, are our most valuable measures for the prevention of these diseases in armies. With reference to the United States Army, the War Department having spoken in General Order No. 17, the responsibility for the intelligent and vigorous enforcement of that order now rests with individual medical and commanding officers, who should properly be held accountable for any excessive prevalence of these diseases in a command.

DIE VERHÜTUNG DER VENERISCHEN KRANKHEITEN AN BORD VON KRIEGSSCHIFFEN.

Marine-Oberstabsarzt Dr. G. A. Rost, Kiel, Germany.

Die venerischen Krankheiten haben seit Jahrhunderten bei fast allen Völkern eine wichtige Rolle im socialen Leben gespielt und tuen dies noch.

Zuverlässige Zahlenangaben über die Höhe dieser Erkrankungen liegen—von ganz wenigen Ausnahmen abgesehen—bis heute nicht vor. Wir sind daher mehr auf Vermutungen angewiesen, dürfen aber wohl mit einiger Sicherheit annehmen, dass zwischen den einzelnen Nationen erhebliche Unterschiede in dieser Hinsicht vorhanden sind.

Es ist zu bedenken, dass bei einem Volke der Stand der venerischen Erkrankungen von einer Reihe besonderer Umstände abhängt, die mit der nationalen Eigenart eng verknüpft sind. Neben der Eigentümlichkeit der Rasse, sind hier Gesetz, Sitte und Anschauung, Bevölkerungsdichte, Stand der Kultur und der Staatseinrichtungen, insbesondere des Sanitätswesens, massgebende Faktoren.

Diese Unterschiede erstrecken sich naturgemäss auch auf den waffentragenden Teil einer Nation—Heer und Flotte; finden sich doch gerade auf dem Gebiete dieser Erkrankungen engste Wechselbeziehungen zwischen der Civil- und der Militärbevölkerung.

Wenn wir nun über den waffentragenden Teil der meisten Nationen sehr gute und brauchbare Morbiditätsstatistiken haben—im

Gegensatz zu dem fast gänzlichen Mangel bei der Civilbevölkerung—so sind Vergleiche dieser Statistiken gerade bezüglich der venerischen Krankheiten doch kaum angängig. Müssen wir hier doch neben den obenerwähnten allgemeinen nationalen Differenzpunkten noch diejenigen sehr beachten, die durch die Verschiedenheit der militärischen Organisation im weitesten Sinne gegeben sind. Es werden insbesondere Art der Zusammensetzung (allgemeine Wehrpflicht, Milizen oder Söldner), Herkunft und Gesundheitszustand der Rekruten, Alter, Besoldung, Anforderungen des Dienstes, Art der Standorte (Grossstädte, flaches Land, Heerlager, Ausland) berücksichtigt werden müssen.

Wir beschränken uns daher im Folgenden darauf, den Stand der venerischen Krankheiten in der Kaiserlichen Marine näher zu beleuchten, verzichten auf Vergleiche mit fremden Nationen und ziehen die Verhältnisse des Deutschen Heeres nur soweit zum Vergleich heran, als dies nach Art der Verhältnisse möglich ist. Bei Betrachtung der Tabelle I ist zunächst zu bemerken, dass in den daselbst gegebenen Gesamtzugangszahlen, die Zahl der Rückfälle und vor allem auch der venerisch krank eingestellten Rekruten enthalten ist. Die genaue Höhe dieser letzteren Zahl ist für die Marine zur Zeitt noch nicht ermittelt—einschlägige Arbeiten sind im Gange—aber unter Zugrundelegung der für die Armee ermittelten Zahlen wird man diese Zahl auf etwa 7 von 1,000 singestellten Rekruten schätzen können, während die Zahl der Rückfälle etwa 6 bis 10 Prozent des Gesamtzuganges an venerischen Krankheiten sein dürfte.

Wenn wir die Zahlen der Kaiserlichen Marine mit denen des Heeres vergleichen, so ist zunächst anscheinend ein enormer Unterschied vorhanden, da die Marine etwa die dreifache Anzahl als jene hat (60 : 20 Prozent). Bei näherer Betrachtung ändert sich das Bild jedoch wesentlich.

Die Zahl der venerisch Kranken innerhalb der Armee schwankt ausserordentlich, sie ist offensichtlich abhängig von der Art der Garnisonen, indem Grossstädte, Industriebezirke und Seestädte hohe, kleine Städte und das flache Land niedrige Zugangszahlen aufweisen. Wir können nun—um Truppen, die unter gleichen Verhältnissen leben mit einander zu vergleichen—nur die am Lande in der Heimat befindlichen Marinetruppen mit solchen der Armee, die in denselben oder ähnlichen Garnisonen, also Seestädten, stehen bezüglich der Erkrankungszahlen vergleichen, während wir die auf eingeschiffte oder im Auslande befindlichen Mannschaften sich beziehenden Zahlen, gesondert betrachten müssen. Wir sehen dann (vergl. Tabelle IV), dass die Zahlen für die Marine nur wenig ungünstiger sind.

Ungünstiger werden sie ceteris paribus stets sein müssen, da noch eine Reihe von Umständen hinzukommen, die besonders geeignet sind, in dieser Hinsicht einzuwirken.

Da ist zunächst das Dienstalter—oder was ja bis zu einem gewissen Grade davon abhängt—das Lebensalter der Mannschaft. Wie wir aus Schwienings Untersuchungen wissen, nimmt die Zahl der venerisch Kranken mit der Zahl der Dienstjahre zu. Da nun in der Marine die Zahl der Leute mit viel Dienstjahren eine sehr grosse ist, infolge der besonderen Art ihrer Organisation, wird sich nach dieser Richtung zunächst ein ungünstiger Einfluss auf den Stand der venerischen Krankheiten erwarten lassen.

Des Weiteren spielen die pecuniären Verhältnisse der Mannschaft eine grosse Rolle, da zweifellos der Besitz von Geld das Aufsuchen von Infektionsgelegenheit erleichtert oder dazu verführt. Ich konnte feststellen, dass an Bord die besser besoldeten Leute in ungleich höherem Masse von der Prophylaxe Gebrauch machten als die minder gut bezahlten. Es lassen sich daraus bezüglich der Häufigkeit des Geschlechtsverkehrs zweifellos Schlüsse ziehen.

Der Einfluss der Besoldung nach dieser Richtung ist besonders von amerikanischen Autoren (aber auch anderen) hervorgehoben worden, da für die U. S. A. Marine und Armee dieser Punkt ganz besondere Bedeutung hat; das gleiche gilt für Heer und Flotte Englands.

Ein weiterer Punkt dürfte der sein, dass in der Marine die Zahl der verheirateten Mannschaften sehr gering ist, da der Seedienst zweifellos für Verheiratete mancherlei Unzuträglichkeiten mit sich bringt. Zahlenmässige Angaben liegen leider weder für die Armee noch für die Marine hierüber vor.

Ausser diesen kommen aber noch Ursachen in Betracht, die mehr psychischer Natur sind. Ich rechne hierzu vor allem das eigenartige Freiheits- und Ungebundenheitsgefühl, das den Seemann so leicht ergreift, wenn er längere Zeit in See gewesen ist und die strengen Fesseln der Schiffsdisciplin ertragen hat. Excesse in Baccho et Venere sind die häufige Folge dieser Stimmung und das letztere bedeutet für den Seemann fast ausschliesslich Verkehr mit der Prostitution; er hat weit seltener wie der Armeesoldat die Möglichkeit, sich ein festes Verhältnis, "einen Schatz," aus der Weiblichkeit seines Garnisonortes zu erwählen.

Ganz besonders treffen diese Verhältnisse für den im Auslande befindlichen Seemann zu, neben dem Reiz des Fremdartigen und Neuen, der gewiss manchen verleitet, kommen hier die stellenweise sehr ungünstigen sanitären Verhältnisse hinzu. Es sind insbesondere gewisse Orte, an denen eine gesetzliche Prostituiertenuntersuchung fehlt, wahre Infektionsherde.

Zusammenfassend lässt sich also feststellen:

Für die Marine sind infolge ihrer besonderen Organisation, der Eigenart ihres Dienstes und der Lebensführung Verhältnisse geschaffen, die von denen des Landdienstes wesentlich abweichen; das trifft in erster Linie die eingeschifften Mannschaften, namentlich im Ausland.

Wir sehen, dass höheres Dienst- bezw. Lebensalter, höhere Besoldung, Junggesellenstand, ferner besondere psychische Einwirkungen durch das Bordleben, daneben erhöhte Gefahr und vermehrte Infektionsgelegenheit, namentlich im Auslande, die wesentlichsten hier in Betracht kommenden Ursachen darstellen.

In der Kaiserlichen Marine sind prophylaktische Massnahmen seit 1900 etwa eingeführt. Sehr bald trat ein deutlicher Rückgang der Geschlechtskrankheiten auf, wie sich aus beistehender Kurve und Tabelle I ergiebt. Es sind namentlich die Trippererkranklungen, in letzter Zeit auch die des Ulcus molle, die erheblichen Rückgang aufweisen.

Der zahlenmässige Anteil der einzelnen Geschlechtskrankheiten am Gesamtzugang verteilt sich folgendermassen: Tripper, 60 Prozent; Syphilis, 30 Prozent; Ulcus molle, 10 Prozent.

VERHÜTUNG DER GESCHLECHTSKRANKHEITEN AN BORD.

Wenn es sich nun auch nicht leugnen lässt, dass die Anwendung der eigentlichen prophylaktischen Mittel das wesentlichste der Geschlechtskrankheiten-Verhütung darstellt, so hat sich diese doch, um günstige Erfolge zu erzielen, auf breiterer Basis aufzubauen. Es bedarf des Zusammenwirkens aller dabei in Betracht kommender Faktoren, und es muss ausdrücklich betont werden, dass die Bekämpfung der Geschlechtskrankheiten an Bord nicht ausschliesslich Sache des Arztes ist, dass auch jede Kommandostelle selbst ein grosses Interesse daran hat. Für die Deutsche Marine ist dies allgemein anerkannt und in verschiedenen Dienstschriften und Verordnungen niedergelegt.

Von den Gegnern der persönlichen Prophylaxe wird öfters der Vorwurf erhoben, dass sie geeignet sei, die Leute zu unsittlichem Lebenswandel anzureizen und Unschuldige dazu verleite.

Ob diese Behauptung sich wirklich durch Beweise erhärten lässt, scheint für denjenigen, der die tatsächlichen Verhältnisse kennt, sehr zweifelhaft. Für die Marine muss dieser Vorwurf auf jeden Fall abgelehnt werden, da hier in erster Linie danach gestrebt wird, die Mannschaft vom ausserehelichen Verkehr abzuhalten.

Sehr wichtig zur Beurteilung der vorliegenden Frage ist eine in der U. S. A. Marine gemachte Beobachtung: Hier konnte, nach dem

letzten Jahresbericht festgestellt werden, dass seit Einführung der Prophylaxe mit der selbst redend eine Aufklärung und Belehrung der Leute Hand in Hand ging, nicht nur die Zahl der Geschlechtskranken als überhaupt die Zahl der Leute, die geschlechtlichen Verkehr gehabt hatten, erheblich zurückgegangen ist. Die Feststellung dieser letzteren Zahl ist dadurch möglich, dass jeder Mann nach Rückkehr an Bord dienstlich befragt wird, ob er Verkehr gehabt hat; bejahendenfalls muss die Prophylaxe angewandt werden. Erkrankt ein Mann nach Verneinung des Verkehrs (*denial of exposure*) wird er wegen falscher Meldung streng bestraft.

Erfolg werden solche Bestrebungen naturgemäss in der Hauptsache bei dem jüngeren Teile der Mannschaft haben. In ethischer Beziehung auf diese Rekruten, Schiffsjungen, Seekadetten, einzuwirken ist die besondere Aufgabe der militärischen Vorgesetzten und der Seelsorger. Ihnen liegt es ob, die ihnen anvertrauten Leute zu sittlicher Lebensführung zu erziehen und anzuhalten.

Worte und gutes Beispiel genügen aber, namentlich für die älteren Leute, allein wohl kaum, man wird sich bemühen müssen, ihnen die geschlechtliche Enthaltsamkeit auch in physischer Beziehung zu erleichtern. In erster Linie ist es wohl der Sport aller Art, der den Gedanken der Leute eine gesunde Richtung gibt und sie auch körperlich günstig zu beeinflussen vermag. Hier ist für jüngere Offiziere ein weites Feld der Tätigkeit offen und weitgehendste Unterstützung durch die Kommandos geboten. Man wird ferner dafür sorgen müssen, dass die Leute lernen ihre Freizeit und ihren Landurlaub nützlich anzuwenden. Dazu dient an Bord eine gute. reichhaltige Bücherei, bei scharfem Verbot aller unzüchtiger Schriften und Bilder, die zuweilen heimlich in Mannschaftskreisen zirkulieren und den Sinn der Leute vergiften. An Land sind Seemannsheime und ähnliche Unternehmungen ausserordentlich nützlich, auch bei ihnen muss auf reichhaltige Lesezimmer, die nicht nur Zeitschriften enthalten, besonders Wert gelegt werden. Belehrende Vorträge, möglichst durch Lichtbildvorführungen unterstützt, musikalische und Theateraufführungen dem Bildungsgrade der Leute angepasst, dürften sich vielleicht als weitere wirksame Hilfsmittel erweisen. Alle diese Veranstaltungen würden gleichzeitig geeignet sein die Mannschaften vom übermässigen Alkoholgenuss abzuhalten. Die verführende Wirkung des Alkohols zum Geschlechtsverkehr ist zu bekannt als dass sie hier näherer Erörterung bedürfte. Es ist ferner keine Frage, dass auch bei unseren Mannschaften eine nicht unerhebliche Zahl von Infektionen in mehr oder minder berauschtem Zustande erworben wird; wenn ich auch nicht behaupten möchte, dass eine besondere Alkoholgefahr in unserer Marine sowohl in allgemeinen wie hinsichtlich der vorliegenden Frage vorhanden ist.

Im Auslande wird es sich empfehlen, Häfen, die als venerisch verseucht gelten, ganz zu meiden oder wenigstens den Aufenthalt dort so kurz wie möglich zu bemessen.

Sehr zweckmässig kann es ferner in solchen Häfen zuweilen sein die Mannschaften nicht Abends zu beurlauben. In tropischen Ländern besonders, wo es früh dunkel wird, bietet sich für die Beurlaubten nach Sonnenuntergang nur wenig Anregung; aus langer Weile geraten sie dann oft in die Schänken und die Netze der Prostitution. Beurlaubungen nur am Tage, Vorträge über die anzulaufenden, unbekannten Häfen, insbesondere Beschreibung der Sehenswürdigkeiten und der auszuführenden Spaziergänge, eventuell Verbot gewisser Strassen und Lokale haben sich als nützlich erwiesen.

Was nun die eigentlichen vorbeugenden Massnahmen betrifft, so ist Erfolg nur zu erwarten wenn Vorgesetzte sowohl wie Mannschaft von ihrer Notwendigkeit und Wirksamkeit überzeugt sind. Hier immer wieder aufklärend und festigend zu wirken ist eine ganz besondere Pflicht des Schiffsarztes. Es empfiehlt sich, das Offizierkorps, aber auch Deck- und Unteroffiziere über den grossen Einfluss der venerischen Krankheiten auf die Gefechtsfähigkeit des Schiffes und den allgemeinen Dienstbetrieb an der Hand des Zahlenmateriales der Sanitätsberichte zu unterrichten und ihre Mitarbeit innerhalb ihres Dienstbereiches, anzuregen. Ihre Unterstützung muss als sehr wertvoll gelten, stehen sie doch den Mannschaften meist näher als der Azt; leider ist aber bei den heutigen gesteigerten dienstlichen Anforderungen diese Mitwirkung sehr erschwert. Auch der verhältnismässig grosse Wechsel von Offizieren und Mannschaften an Bord ist allen solchen Bestrebungen wenig förderlich. Unter diesen Umständen müssen die durch den Schiffsarzt den Mannschaften zu erteilenden Belehrungen und Vorträge, die in der deutschen Marine bestimmungsgemäss monatlich wenigstens einmal stattfinden sollen, nach meinen Erfahrungen als ein ganz besonders wichtiges Unterstützungsmittel zur "Erziehung der Mannschaft zur Prophylaxe"[1] angesehen werden. Je grösser das Vertrauen ist, das der Schiffsarzt bei der Mannschaft geniesst, desto grösser wird sein Einfluss in dieser Beziehung sein. Es muss versucht werden in jedem einzelnen Manne das Gefühl wachzurufen, dass er bei Unterlassung der Prophylaxe sich tatsächlich eines schweren Fehlers gegen sich und andere schuldig macht und nicht bloss der Übertretung eines Schiffsbefehls.

Die oben erwähnten Belehrungen müssen zwar in knapper Form doch möglichst fasslich die Gefahren der Geschlechtskrankheiten, die Art ihres Auftretens und die Möglichkeit ihrer Verhütung behandeln. Das Wesen der vorbeugenden Behandlung muss erklärt und daneben immer wieder grösste Sauberkeit an den Genitalien anempfohlen werden.

Bei den vorbeugenden Massnahmen selbst bedarf es zunächst eines kurzen Überblickes über die hierfür in Betracht kommenden Mittel. Wir sehen hierbei ab von allen den oben bereits gestreiften Massnahmen (Waschungen), und betrachten nur die modernen keimtötenden Mittel, soweit sie bisher—namentlich in der Marine—praktisch erprobt und brauchbar befunden worden sind.

Zur Verhütung von Tripper ist ursprünglich die Einträufelung einer 2 Prozent Argentum nitricum Lösung in die Harnröhre angegeben worden und hat sich auch als hinreichend sicher erwiesen. Ein grosser Übelstand haftet dem Mittel jedoch insofern an, als nach seiner Anwendung recht oft Reizungserscheinungen an der Anwendungsstelle auftreten. Die Mündung ist dann, zuweilen beträchtlich, gerötet und geschwollen, leicht verklebt, auf Druck quillt etwas schleimig-eitrige Flüssigkeit hervor, beim Wasserlassen werden brennende oder stechende Schmerzen empfunden. Diese Erscheinungen, die denen eines beginnenden Trippers nicht unähnlich sind, die infolgedessen die Leute lebhaft beunruhigen und ihr Zutrauen zu dem Verfahren schwächen, werden bei Anwendung sogenannter "organischer" Silberpräparate fast völlig vermieden. Von diesen haben sich in der deutschen Marine bisher am besten bewährt: Protargol (Argentum proteinicum), 20 Prozent; Albargin, 5 Prozent, u. a. Diese Lösungen sind jedoch nur begrenzt haltbar, namentlich in den Tropen sieht man ziemlich rasche Zeretzung eintreten. Sie sind deshalb öfter frisch zu hereiten (in kalter Aqua destillata auflösen) und vor Wärme und Licht geschützt aufzubewahren.

Der von einigen geübte Zusatz von Glycerin scheint mir—in Übereinstimmung mit Kopp—unnötig zu sein, ebenso wie ich den neuerdings empfohlenen Zusatz von Alypin, bei Protargol wenigstens, nicht als erforderlich ansehen kann, da die Einträufelung Schmerzen nicht hervorruft. Die Anwendung von 20 Prozent Protargol, die auch vom wissenschaftlichen Senat der Kaiser Wilhelm Akademie empfohlen wurde, zieht im allgemeinen keinerlei Reizerscheinungen nach sich; ab und zu sieht man allerdings am Morgen nach der Anwendung ein kleines Tröpfchen bakterienfreies milchiges Sekret an der Harnröhrenmündung, das ist aber auch alles. Auf die grosse Reihe der sonstigen, meist gebrauchsfertig in den Handel kommenden Gonorrhœ-Prophylaktica kann hier nicht näher eingegangen werden, da sie, obwohl teilweise sehr handlich in ihrer Anwendung (Protector, Blokusewski, u. s. w.), doch für den allgemeinen Gebrauch an Bord schon der Kosten wegen nicht in Frage kommen. Einzelne haben sich auch als nicht ganz zuverlässig erwiesen, so ist von "einigen" mehrfach berichtet worden, dass der Inhalt der Tuben nach längerem Lagern oder bei warmer Temperatur (Tropen) völlig ausgetrocknet war.

Auf die Art der Anwendung der oben empfohlenen Mitteln werden wir später noch einzugehen haben. Was ihre Wirkung betrifft, so kann man wohl sagen, dass bei rechtzeitiger und sachgemässer Anwendung, normalen Befund der Harnröhrenmündung vorausgesetzt, ein fast absolut sicherer Erfolg, d. h. Schutz gegen die gonorrhoische Infektion damit zu erreichen ist. Fällen, in denen trotz der rechtzeitig angewandten Prophylaxe eine Erkrankung auftritt, wird man zwar ab und zu begegnen, man kann aber beinah stets eine Ursache ausfindig machen: verdorbene Lösung, unsachgemässe Anwendung, ungünstiger Bau der Harnröhrenmündung.

Auf einen Punkt, der früher wohl viel dazu beigetragen hat, die Meinung von der Unzuverlässigkeit der Prophylaktica hervorzurufen, sei besonders hingewiesen. Nicht zu selten kommt es vor, dass Mannschaften sich erst dann der vorbeugenden Massnahmen unterziehen, wenn sie, einige Tage nach dem Beischlaf, die ersten—subjektiven—Anzeichen einer Erkrankung merken. Um diese Zeit werden häufig objektiv wahrnehmbare Erscheinungen am Glied noch nicht deutlich ausgeprägt sein. Wenige Tage später melden sie sich mit der voll ausgebrochenen Erkrankung krank und erwecken so den Anschein, als seien sie trotz richtig angewandter Prophylaxe erkrankt. Schutz gegen solche Hintergehungsversuche ist am besten dadurch zu erreichen, dass das Sanitätsunterpersonal zu scharfem Aufpassen bei Ausführung der vorbeugenden Massnahmen erzogen wird. Es muss ihnen streng zur Pflicht gemacht werden, dass sie alle Leute mit verdächtigen Erscheinungen (schwache Rötung und Wulstung der Mündung, Zusammenkleben derselben, schleimige Absonderung sind für die beginnende Trippererkrankung, kleine Bläschen oder Hautabschürfungen für beginnende Schanker charakteristisch) zur Meldung bringen.

Viel schwieriger als die Verhütung der Gonorrhœ durch keimtötende Mittel gestaltet sich diejenige der Syphilis und bei der grossen Verschiedenheit des Infektionsvorganges beider Erkrankungen kann dieses auch nicht sehr verwunderlich erscheinen. Näher hierauf, insbesondere auf die Untersuchungen Neissers und K. Sieberts sowie Metschnikoffs einzugehen, verbietet sich leider an dieser Stelle; wir müssen uns damit begnügen, festzustellen, dass es hier nicht wie beim Tripper auf und in den obersten Schichten der Schleimhaut der Harnröhrenmündung wuchernde Kokkenkolonien sind, deren Abtötung erforderlich ist, dass es veilmehr gilt, einen mit grosser eigener Beweglichkeit ausgestatteten Erreger vom Eindringen in die Blutbahnen abzuhalten. Bis zu einem gewissen Grade ist das zwar schon durch mechanische Massnahmen möglich. So wird zweifellos durch eine Ausdehnung der regelmässigen Hautflege auch die Vorhaut (Waschungen und Einfetten), also durch Reinlichkeit, diese in einen solchen Zustand versetzt, dass dem Entstehen von Rissen und Schrun-

den—den Eintrittspforten des Krankheitsgiftes—vorgebeugt wird. Man könnte vielleicht noch weiter gehen und eine gewisse Gerbung der sonst so zarten Haut anstreben und dazu regelmässige Alkoholwaschungen verwenden.[2]

Dass die Beschneidung in dieser Hinsicht durch die danach entstehende Veränderung der Vorhaut in Form und Beschaffenheit allein schon einen hohen Schutz gewährt, ist eine seit langem bekannte und kürzlich auch von einem russischen Autor zahlenmässig gestützte Tatsache.

Von den keimtötenden Mitteln ist es bis heute zweifellos das Sublimat (Hydrargyrum bichlorat), dem die relativ grösste Wirksamkeit allerseits zugesprochen wird. Waschungen mit 1 bis 2 Prozent Lösung, ev. mit einem nachfolgenden feuchten Umschlag dieses Mittels kombiniert, sind nach den von uns und anderen erzielten Resultaten als recht sicher wirkend anzusehen, sofern sie rechtzeitig, d. h. spätestens nach 5 bis 6 Stunden, vorgenommen werden. Ob die mehrfach empfohlene 3 Prozent Lösung besseres leistet, scheint immerhin fraglich; sie rief—wie ich mich überzeugen konnte—öfters erhebliches Brennen bei empfindlichen Leuten hervor. Dagegen scheint mir der neuerdings von K. Siebert empfohlene Zusatz von Alkohol, der die desinfizierende Kraft der Sublimatlösung wesentlich erhöhen soll, auch in Rücksicht auf meinen oben erwähnten Vorschlag zweckentsprechend. Die Höhe der Alkoholkonzentration dürfte sich wesentlich nach der individuellen Empfindlichkeit richten und zwischen 10 und 25 Prozent etwa schwanken. Eine ähnliche gute Wirkung wie dem Sublimat wird dem Hydrarg. oxycyanat. zugeschrieben.

Das von Neisser und K. Siebert angegebene Disinficiens[3] enthält Sublimat und Alkohol, es ist durch Gelatine in salbenartige Form gebracht und damit sehr handlich in seiner Anwendung. Erfahrungen über seine Wirksamkeit und Haltbarkeit, in den Tropen besonders, liegen in grösserem Umfange noch nicht vor. Immerhin dürften Versuche damit oder in der von Sklepinski angegebenen Modifikation (D. M. W., 1912, Nr. 14) sehr empfehlenswert sein.

Über die Wirksamkeit der von Metschnikoff empfohlenen 33 Prozent Calomelsalbe sind bisher besonders günstig lautende Berichte kaum vorhanden und auch nach meiner eigenen Erfahrung sind bessere Resultate als bei dem alten Verfahren nicht zu erzielen; sichere Infektionen jedoch trotz frühzeitiger Andwendung sind dagegen mehrfach beobachtet. Die gerühmte Wirkung dieser Salbe musste von vornherein Zweifeln begegnen, da es schon durch ältere Untersuchungen R. Kochs bekannt war, dass keimtötende Mittel in Vehikeln aus der Fettreihe ganz erheblich an Wirksamkeit verlieren.

Welchem Desinfiziens man aber auch den Vorzug geben mag, man wird sich stets bewusst sein müssen, dass es einen absoluten Schutz gegen die syphilitische Infektion—wie bei der Gonorrhœ fast erreicht ist—nicht gewähren kann, ja dass selbst unmittelbare Anwendung nach der Übertragung des Erregers eine Infektion oft nicht verhindern wird. In vielen Fällen wird es aber trotzdem wirksam sein und—in geeigneter Weise mit dem Prophylakticum gegen Gonorrhœ kombiniert—als eine gute Waffe in dem Kampfe gegen die venerischen Krankheiten auch an Bord sich bewähren.

Dass die gegen die Syphilisinfektion empfohlenen Mittel zugleich auch die Übertragung des weichen Schankers zu hindern vermögen, ist ergänzend noch nachzutragen.

Die Art der Anwendung der kombinierten Prophylaxe also der gegen Tripper, Syphilis und Ulcus molle gerichteten, wie sie in der Kaiserlichen Marine üblich ist, gestaltet sich kurz folgendermassen: Nach gründlichem Reinigen des Gliedes, insbesondere der Eichel, Kranzfurche und Vorhaut mit Benzin[4] werden 2 bis 3 Tropfen 20 Prozent Protargollösung mittelst Pipette in die mit 2 Finger klaffend geöffnet gehaltene Harnröhrenmündung eingeträufelt—nicht gespritzt—sowie einige Tropfen in ihrer äusseren Umgebung verteilt. Die Flüssigkeit wird 1 bis 2 Minuten "stehen" belassen, danach folgt ein gründliches Abreiben des Gliedes mit der 1 oder 2 Prozent Sublimatlösung und eventuellen Einlegen eines damit getränkten Wattestreifens in die Kranzfurche.

Die wirksame Durchführung diesser prophylaktischen Massnahmen an Bord setzt selbstverständlich voraus, dass ihre Anwendung durch Schiffsbefehl für jeden Mann—einschliesslich der Unteroffiziere—der ausserehelichen Geschlechtsverkehr gehabt hat, angeordnet wird. Es ist namentlich in früheren Jahren versucht worden, der Mannschaft die Prophylaxe nur anzuempfehlen, ohne einen direkten Zwang auszuüben; die dabei erzielten Resultate waren jedoch wenig befriedigend. Es wird unter einer so grossen Zahl junger Leute, wie es eine Schiffsbesatzung ist, stets eine Reihe leichtsinniger oder indolenter Elemente geben, die auf Belehrung garnicht, auf Zwang sehr viel eher reagieren. Die "Prophylaxe" muss daher obligatorisch sein und es wird sich dann nicht vermeiden lassen, gegen Säumige mit Strafe vorzugehen. Ausser den unsrigen sprechen auch die neuerdings in der U. S. A. Marine gemachten günstigen Erfahrungen sehr dafür (Kean).

Da die vorbeugenden Massnahmen jedoch nur innerhalb einer begrenzten Frist eine sichere Wirkung zu entfalten vermögen, ist es ferner notwendig, für die Vornahme der dienstlich angeordneten Prophylaxe eine bestimmte Frist festzusetzen; sechs Stunden dürfte nach den Versuchsergebnissen das Äusserste sein. Möglichst frühzeitige Anwendung ist daher mit allen Mitteln zu erstreben, spätere

wird als nutzlos angesehen und schützt im Falle einer Erkrankung nicht vor Strafe.

Sehr wesentlich ist, dass die prophylaktischen Massnahmen genau in der oben geschilderten Weise vorgenommen werden. Es wird sich daher in der Regel nicht empfehlen, sie durch den Mann selbst, der an sich keine Garantie für sachgemässe Ausführung bietet und manchmal auch durch Müdigkeit oder Trunkenheit kaum imstande dazu sein dürfte, ausführen zu lassen, sondern das Sanitätsunterpersonal damit zu beauftragen. Nur hierdurch wird es möglich, die Ausführung zu überwachen und solche Leute, die bereits Zeichen einer beginnenden Erkrankung erkennen lassen, von der Vornahme auszuschliessen. Voraussetzung ist natürlich, dass das ausführende Personal genau über die Zeichen der beginnenden Erkrankung, über die Handhabung und die Wichtigkeit dieses Dienstes unterrichtet ist; auch muss ihnen stets gegenwärtig sein, dass sich die Pflicht der Verschwiegenheit ebenso auf diesen Dienst bezieht.

Der Ort der Vornahme soll so beschaffen sein, dass er dem Blick Unbeteiligter entzogen ist; am besten also ein abgeschotteter Raum des Schiffslazaretts (Verbandraum, Badekammer). Er muss genügend hell erleuchtet sein, damit der Ausübende etwaige Krankheitszeichen entdecken kann.

Leider lassen sich die vorstehend geschilderten vorbeugenden Massnahmen bei einer Gelegenheit, wo erfahrungsgemäss recht viel Infektionen erworben werden, nicht durchführen, das ist, beim Heimatsurlaub unserer Mannschaften. Hier den Leuten wenigstens die fakultative Ausführung der Prophylaxe durch ein handliches Besteck zu ermöglichen, ist ein Wunsch, dessen Erfüllung mit erheblichen Schwierigkeiten verbunden ist und nur von der Zukunft erwartet werden kann.

Zum Schluss seien noch die Massnahmen kurz erwähnt, die dazu dienen sollen die Übertragung von Geschlechtskrankheiten von einen Mann auf den anderen—die extragenitale Infektion—zu verhindern. Die Möglichkeit hierzu ist, wie schon eingangs betont, gerade an Bord infolge des engen Zusammenlebens recht gross; trotzdem ereignen sich Infektionen nur sehr selten, da schon seit langem durch Dienstvorschriften vorgesorgt ist. Sehr wichtig sind, vor allem die vorgeschriebenen monatlichen Untersuchungen der Mannschaft, sie ermöglichen es einerseits Geschlechtskranke, die oft gar keine Kenntnis von ihrer Erkrankung haben, auszusondern und der Behandlung zuzuführen und verhüten dadurch andererseits, dass durch geschlechtskranke Leute die Infektion in die Civilbevölkerung hineingetragen wird. Näher auf diese Untersuchungen einzugehen, erübrigt; von den uns hier beschäftigenden Gesichtspunkten aus ist nur besonders zu betonen, dass folgende Bedingungen erfüllt sein müssen: (1)

Heller Untersuchungsraum; (2) Anwesenheit aller in Betracht kommenden Mannschaften (Burschen, Ordonnanzen, u. s. w.), da gerade solche, die fürchten, als geschlechtskrank befunden zu werden, oft alles mögliche versuchen, sich zu "drücken;" unvermutete Untersuchungen und namentliche Kontrolle sind hierbei wichtige Hilfsmittel; (3) Entblössung eines möglichst grossen Teiles des Körpers, mindestens des Rumpfes vom Halse bis zur Genitalgegend.

Sehr wünschenswert ist es, dass diese Untersuchungen, die selbstverständlich unter möglichster Schonung des Schamgefühls der Leute auszuführen sind—Unteroffiziere für sich gesondert—nicht lediglich als Untersuchungen auf Geschlechtskrankheiten ausgeführt werden. Entsprechend der grossen Wichtigkeit auch für die Kenntnis des Allgemeinzustandes der Leute und der oft beträchtlichen Schwierigkeit im Erkennen krankhafter Zustände, halte ich die Ausführung der Untersuchungen durch erfahrenere Ärzte für unerlässlich; bei Anwesenheit zweier Sanitätsoffiziere an Bord müsste nach meiner Meinung nicht nur dem jüngeren diese Aufgabe zufallen.

Sind Leute mit verdächtigen Erscheinungen in Beobachtung gekommen, so ist mit allen Hilfsmitteln danach zu streben, bald eine sichere Diagnose zu erlangen, um ansteckungsfähige Fälle so rasch als möglich auszusondern. Sicher geschlechtskranke Mannschaften sind in der Heimat bestimmungsgemäss den Lazaretten am Lande zu überweisen, da sie zweifellos als Infektionsquellen für die übrige Mannschaft eine Gefahr darstellen.

Sehr wesentlich ist es weiterhin, dass die als geheilt Entlassenen, venerisch erkrankt gewesenen Mannschaften, regelmässig nachuntersucht werden, wie es in der deutschen Marine schon seit längerem dienstlich vorgeschrieben ist. Die Dauer der Nachuntersuchungen hat sich bei Tripper auf mindestens sechs Wochen, bei Syphilis auf wenigstens ein Jahr zu erstrecken. Bei letzterer Erkrankung ist es notwendig die Ausführung der Serumreaktion in gewissen Zeitabschnitten anfangs monatlich, später etwa alle drei Monate zu veranlassen, um Rückfällen, die sonst leicht unbemerkt bleiben, vorzubeugen. Auch darf man nicht versäumen, die an Ulcus molle erkrankt gewesenen Leute serologisch noch nachzukontrollieren, da unter dieser relativ harmlosen Erkrankung zuweilen doch noch eine syphilitische verborgen sein kann.

Ich glaube, in vorstehenden Ausführungen, die sich im Wesentlichen auf eine längere Erfahrung an Bord von S. M. Schiffen im Auslande wie in heimischen Gewässern sowie auf die in den Sanitätsberichten für die kaiserliche Marine niedergelegten Beobachtungen stützen, die Zweckmässigkeit und Durchführbarkeit der combinierten, individuellen Prophylaxe dargetan zu haben.

Ich bin weit davon entfernt die bisher bei uns erzielten Resultate als nicht mehr verbesserungsfähig anzusehen; ich hoffe im Gegenteil, dass unsere jetzigen Erfolge nur eine Etappe sind auf dem Wege zur möglichst völligen Unterdrückung der venerischen Krankheiten. Freilich wird es, solange die Bekämpfung dieser Krankheiten in der Civilbevölkerung nicht energischer allerwärts in die Hand genommen wird, auch entsprechend länger dauern.

Der Kampf gegen die "Geschlechtskrankheiten an Bord" wird also in letzter Linie am Lande ausgefochten werden müssen.

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[1] Der Begriff "Prophylaxe" vorbeugende Massnahmen bezw. deren Ausführung hat sich in diesem erweiterten Sinne infolge seiner Kürze in der Marine allgemein eingebürgert und soll daher auch hier beibehalten werden.

[2] Die nach dieser Richtung unternommenen Versuche sind noch nicht abgeschlossen, sie sollen später mitgeteilt werden.

[3] Hergestellt von Dr. Byk, Chem. Fabrik, Charlottenburg.

[4] Seifenwaschung ist in Rücksicht auf die nachfolgende Sublimatanwendung nur dann erlaubt, wenn gründliches Abspülen oder Abtrocknen ihr folgt. Die Anwendung von Benzin ist ohne Unzuträglichkeiten gut möglich, es ruft nur bei einzelnen besonders empfindlichen geringes Brennen hervor. Dafür vermag es aber infolge der Entfernung des Fettes und der anhaftenden Schleimreste zur Erzielung einer besseren Tiefenwirkung des Desinficiens wesentlich beizutragen.

PROPHYLAXIS OF THE VENEREAL DISEASES IN THE RUSSIAN NAVY.

Surg. Gen. A. A. Zohbt, medical officer, state counselor, St. Petersburg, Russia.

I do not think it necessary to explain how very important is the question of venereal diseases, not only from the point of view of hygiene, and the life of sailors and soldiers, but for the whole population of a country.

At the end of their term of service the men return to their own villages, where it is impossible to have the sanitary inspection as efficient as it ought to be; therefore they often infect people surrounding them; and even if the disease appears to have been cured, it may prove communicable after marriage. The men affected by venereal diseases have to give up their actual service (which without that is very short) for a long time, and consequently are behind the others in the service. After a long stay in the hospital, where they feel very comfortable, the men get lazy, and on returning to their respective duties are not so active and do not take to their work with the same energy.

The above principally concerns the navy, where everyone's duty is strictly defined, and therefore every absence is greatly felt and is a detriment to the service.

In the navy the number of men affected by venereal diseases has always been larger than in the army. This is explained by many reasons. For instance, the sailor's wages are higher than those of

soldiers; shore leave is rarely granted the men; they visit different ports, etc.

During my long service in the navy I have observed that the more shore liberty the sailors have the less cases of drunkenness are to be noticed, and consequently less venereal diseases, because the majority of these diseases are caught when men are drunk.

In the Russian Navy for a long time all that was possible has been done to decrease the number of cases of venereal diseases among the sailors, and for that reason attention has been directed, not to the sailor affected by the disease, but to his surroundings.

In the seaports long ago committees were formed of military members and members of the sanitary police service to register and inspect prostitutes, but in spite of severe measures these committees have not been able to cope with secret prostitution.

For 20 years libraries and places where sailors can get tea and other soft drinks have existed in the barracks, but naturally it has not been possible to prevent the sailors from seeking other amusements outside the barracks, and for this reason temperance societies with free diversions for the sailors have also been organized.

The sanitary inspection of the sailors has existed for a long time and continues to take place once a week on board ships and in the barracks. Those who have venereal diseases are sent to hospitals. The surgeons inquire where and by whom the sailor has been contaminated and report the result of the inspection to the sanitary police service. Very often the sailors refuse to give information about the women with whom they have had relations.

When the sailors who have had syphilis leave the service after the end of their term, they receive a special paper showing the state of the disease, and after what period of time they can get married. The bearer of such a paper must present it to the military chief of his district (who keeps the records of the men in reserve) and to the village authorities.

Since 1906, lectures are arranged for the entertainment of sailors on all the ships. Among others, they have had lectures about venereal diseases. Also for their entertainment moving pictures are shown, and the sailors give amateur plays. In spite of all these diversions, one has not been able to succeed in reducing the numbers of cases of venereal diseases, and at Libau in 1908 the number of these cases reached 60 per cent of all diseases.

It is seen that all the measures already taken have not had the desired results; for this reason, in 1909, the new chief of the bureau of medicine and surgery of the Imperial Russian Navy established the following regulations of prophylaxis to be used against venereal diseases:

(1) The medical inspection must take place every week, and the whole crew must be examined not less than twice a month.

(2) The medical officers must arrange as often as possible to give lectures about venereal diseases, and in clear and simple language explain to the sailors about the different venereal diseases, the danger of infection, and the prophylaxis.

(3) The ship authorities and doctors remind the sailors who are on shore leave that those who have any relations with women must, on their return, go to the ship's hospital to take prophylactic measures.

(4) Those who have just had relations with a woman must immediately urinate and, if possible, wash their sexual organs. On returning to the ship, they are obliged to go to the hospital, where they again wash their sexual organs with a solution of sublimate or with lukewarm water and soap. In the urinal passage a 20 per cent solution of protargol is injected, and the prepuce and head of the penis is rubbed with a 33 per cent ointment of calomel, which must remain there for at least two hours.

Each member of the crew is given a pamphlet containing a description of venereal diseases and the measures of precaution to be taken against them. Instructions concerning prophylactic measures are communicated to the medical officers to be given only to those sailors who wish to know them, and for this reason no punishment is established for transgressing these rules.

Notwithstanding that there is no punishment for not following these rules, it is rather difficult to explain their necessity to the naïve men, who distrust all that is new to them. This is confirmed by different authors.

To show the use of prophylactic measures in the Russian Navy, and not wishing to tire my listeners with too many tables, I will cite only the following:

In 1910, in the Baltic Fleet, out of 182,078 applications, 13,410, or 7.3 per cent of the whole number, were for prophylactic measures. Of these, 45 men, or 0.4 per cent of those who applied to the hospitals, fell ill. The total number of venereal patients was 1,539, or 0.8 per cent of all the seamen, and in this total the relapses are included.

To compare the two following years, 1910 and 1911, I will take two divisions of ships of the Black Sea Fleet. In the other divisions of the same fleet the changes were significant.

In 1910, in one of the divisions, out of 45,484 applications, 4,273 were for prophylactic measures; that is, 9.04 per cent of the whole number. Of those who applied to the hospitals, 30 men became ill, which makes 0.7 per cent. The total number of venereal patients was 366, or 0.8 per cent of all the seamen.

In 1911, of the annual number of 51,842 applications, 3,997, or 7.3 per cent, applied for prophylactic measures. Among the latter, 12 men, or 0.3 per cent of the whole company, fell ill. The total number of venereal patients was 311, or 0.7 per cent of all the seamen.

For the first six months of 1912, in the same division, the number of applications was 7.6 per cent of all the seamen, 0.4 per cent of

whom fell ill. The total number of venereal patients was 0.6 per cent of the whole complement.

In the Black Sea, in the gunnery training division, in 1911, the total number of applications to the hospital was 10.3 per cent of the total number of sailors, and in 1910, 7.2 per cent.

The success of preventive measures greatly depends upon the personel relations between doctors and enlisted men. In looking through the statistics of our navy I found a case where on one of the ships the prophylactic measures were very well established, and after this doctor was transferred to another ship the number of applications for prophylactic measures increased 10 times.

The battleship *Panteleimon* can be given as an example of the successful use of prophylactic measures.[1] In 1910 the number of applications reached 17.8 per cent of the total number of sailors. Of those who applied to the hospital 0.4 per cent fell ill. The total number of venereal patients was 0.36 per cent of all the complement.

In 1911 the number of applications was lower. It was 12.9 per cent; 0.04 per cent of the applicants fell ill. The total number of venereal patients was 0.19 per cent.

These examples and the statistics of our fleet show us that the improvement in prophylaxis has not been very successful if we consider the number of applications; they vary between 7 and 12 per cent and rarely reach 18 per cent of the total number of sailors. The great utility of prophylaxis is, however, evident, as the number of men who fell ill after the use of these measures does not reach 1 per cent. The number of cases of venereal diseases varies between 0.7 and 0.9 per cent and in one case only reaches 0.19 per cent.

Of the number of diseases after the use of prophylactic measures, one notices about 75 per cent of urethritis cases and 25 per cent of hard and soft chancre. It is also noticed that in most cases the diseases are milder with people who have been subjected to prophylactic measures. In most cases the patients who fall ill are those who have been subjected to prophylactic measures four hours or more after the act. The urethritis depends, apparently, on whether the patient urinated or not after the act.

Prophylactic measures in Russia were started at the same time as in the United States and in Italy, and these two countries, as far as I know, have obtained about the same results as we did.

Capt. Edward Vedder, complaining against the unwillingness of sailors to submit themselves to these measures,[2] proposes that the Government should take this matter in its own hands and issue regulations, as is done for other infectious diseases; that the physiology and pathology of sexual life be taught in schools; and that the development of sanitary police inspection be undertaken.

Maj. Will Lyster[3] also asks for obligatory prophylactic regulations with the cooperation of the military and navy authorities.

Maj. Deane C. Howard[4] proves that, with obligatory regulations and punishments, in several detachments the number of venereal diseases was lowered and in some of them there were no cases at all.

The same thing was proved by Surg. Holcomb and Surg. Moran.[5]

In Italy, Dr. Rho[6] takes into consideration the great usefulness of prophylaxis and regrets that there are no obligatory regulations nor punishments in cases of transgression of these rules.

In conclusion, I take the liberty to again insist upon the great importance of venereal prophylaxis to the sanitary status of the army and the navy, and the condition that it be obligatory.

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[1] Navy Surgeon, September, 1912, article of Dr. Gourvitch.
[2] The Military Surgeon, November, 1911.
[3] Idem, July, 1911.
[4] Idem, December, 1911.
[5] United States Naval Medical Bulletin, 1912.
[6] Annali di Medicine navale e coloniale, 1912, page 190.

THE HOSPITAL SHIP: A COMPONENT PART OF THE FLEET, AND THE REPAIR SHIP FOR THE PERSONNEL.

CHARLES F. STOKES, A. M., M. D., D. Sc., LL. D., Surgeon General, United States Navy.

The aim of the battle fleet is to develop the highest possible degree of military efficiency in its personnel and material, and to become as far as possible self-sustaining. The repair ship for material has long since demonstrated its usefulness to the fleet.

It is estimated that at least two years of training are required to properly qualify the enlisted men for their complicated and specialized duties. If this be so, then on military and economic grounds it becomes our paramount duty to safeguard the personnel by the employment of the highest type of preventive medicine and by bringing to bear on the officers and men of the fleet all there is in medicine and surgery that will add to their fighting efficiency.

This end can best be attained, as has been demonstrated in the United States Navy, by having a properly organized and equipped hospital ship as a component part of the fleet, working in conjunction with the sanitary personnel of the fighting ships. To obtain the best results, this type of ship should be built and equipped primarily to meet the activities and responsibilities of the fleet in peace times; its activities in war, as will be pointed out later, are restricted. The ship need not be large; a bed capacity of 250 would be ample. Still, it should be speedy and stable and, for obvious reasons, should

be propelled by oil-burning engines. From the studies of Richards and others we know that the deaths from drowning in naval warfare about equal the deaths from gunfire. Many lives that are thus needlessly sacrified might be saved. To this end the hospital ship should be equipped with speedy power boats having special devices for the rescue of those on sinking ships or those already in the water. Other provision is made for the wounded.

The radically different activities of the hospital ship in peace and war and its necessity as a component part of the fleet at all times will best be instanced by one or two examples. Let us suppose that a valuable member of a gun crew, such as a gun captain or gun pointer, is stricken with appendicitis or develops a hernia and an operation is imperative. He is at once transferred to the hospital ship and there falls into the hands of a skilled surgeon, with trained assistants and attendants and the equipment and atmosphere of our best hospitals on shore. This procedure will generally lead to a shortened convalescence and an early return to his ship and station, thereby minimizing the crippling of his gun crew. On the other hand, if there were no hospital ship in the fleet the medical officer might be forced to perform an operation of urgency under the unfavorable conditions for such work existing on board the battleship, which would be likely to lead to unsatisfactory results and delayed return to duty; or, if his ship were in port and a hospital near by, the patient would probably be sent on shore. Thus, in the event of the removal of the fleet to another port the man's return to his ship might be unduly delayed or become impracticable. The damage to efficiency and loss of service from this cause is worthy of consideration.

As contagious diseases are particularly liable to embarrass the fleet, ample provision should be made for the isolation and treatment of these cases on the hospital ship. Battleships have been obliged to leave the target range and fleet on account of communicable disease, thus interfering materially with the work of the fleet. When the Atlantic Fleet that encircled the world arrived at Honolulu from San Francisco there were 59 cases of contagious disease in that fleet, including scarlet fever, diphtheria, measles, mumps, and chickenpox. These patients were immediately isolated on the hospital ship *Relief*, the necessary disinfection of the ships was accomplished, and the officers and men, when shown to be bacterially free from disease, were allowed on shore. No further cases developed in the fleet or on the hospital ship, and on subsequent inquiry it was learned that no cases traceable to the visit of the fleet occurred on shore. The sick were returned to their respective ships at Auckland, New Zealand, thus leaving no stragglers behind, and the formation of the fleet was preserved, which would not have been feasible but for the presence of the *Relief*. Special provision should be made for tuberculosis

patients, and ample space should be allotted to the care of the insane, in order that they may be humanely and satisfactorily dealt with. It is sometimes necessary to retain these individuals on board the hospital ship for prolonged periods; their prompt removal from the fighting ships is imperative.

The sanitary personnel of the hospital ship should be made up of medical officers who have specialized in the different fields of medicine and surgery. There should be at least one general surgeon, one physician, one officer skilled in eye, ear, nose, and throat work, one bacteriologist and pathologist, and one radiologist. In addition, there should be one chemist for food and other analyses, and at least two dental surgeons.

These officers should be thoroughly equipped with the necessary instruments and apparatus to carry to completion the work in their special fields. It is probable that the medical outfits on battleships might be thus reduced to the bare necessities of a ship acting singly. The medical officers of the hospital ship are always available as skilled consultants in perplexing cases or when sanitary difficulties arise in the fleet.

In association with the fleet officers the hospital-ship officers study the varied problems in industrial and occupational hygiene as applied to the Navy, averting disability here and improving physical fitness there. For example, a study of the visual defects of gun pointers and their prevention has been carried out; the prevention of retinal injury to those using searchlights; the special treatment of nose and throat lesions to avert impaired hearing from diving, gun blasts, and other causes. The problem of sustaining life in disabled submarines has been given exhaustive study, and, too, the visual effects of the submarine periscope have received attention. There are unsolved problems in turrets, firerooms, and elsewhere. It might be well to assign a psychiatrist to the hospital ship not only to care for the insane but to make studies in temperamental fitness or psychic analysis of the personnel.

From this brief outline of its activities the enormous value of the hospital ship to the fleet in helping to accomplish military effectiveness is apparent. The sanitary service of the entire fleet is materially bettered. The humanitarian responsibilities of the medical department are better met.

The hospital ship with the Atlantic Fleet is provided with a good medical reference library, to which all officers have access. At stated times all medical officers who can attend are ordered by the commander in chief to gather on the hospital ship to discuss medico-military affairs, read papers, or hold clinics. These conferences are of great value, in that they tend to unify methods of procedure, stimu-

late professional activity and interest, and bring all medical officers into close touch.

The hospital ship is the medical supply ship of the fleet and should be stocked to meet the demands of the fleet at all times. In cases of national disaster or of serious mishap in the fleet the hospital ship is of incalculable value along humanitarian lines.

When landing parties are operating in the field, the hospital ship not only provides them with the major part of their field equipment, but acts as a base hospital as well.

In naval warfare the field of activity for the hospital ship of the fleet must of necessity be restricted. It would be impracticable to keep in continuous commission with the fleet a ship larger than necessary to meet the everyday demands of the fleet in peace times, especially as the care of the wounded has been otherwise provided for.

Before going into battle the hospital ship should remove all the sick from the ships of the fleet and see that the ships are amply supplied with sterile first-aid dressings and appliances. It should be assigned to special work; for instance, to save people from drowning, if possible, without undue hazard or interference with the combatants; to follow up a chase; or possibly to accompany a single ship or group of vessels; or to look out for some of the minor ships of the fleet.

By reason of its restricted bed capacity and limited personnel, the hospital ship, during and after battle, becomes relatively inconsequential in the face of a situation where it is possible, inside of half an hour, to have an accumulation of from eight to ten thousand casualties. Other provision should be and has been made to meet this appalling demand on the medical department.

DISCUSSION.

Dr. E. M. Simons, Berlin-Charlottenburg: Ich glaube, man wird dem Vortrage des Herrn Generalarztes Stokes eine grosse prinzipielle Bedeutung beilegen müssen, deshalb weil Redner zu meiner freudigen Ueberraschung die hohe Wichtigkeit der Hospitalschiffe gerade für die Zeit des Friedens betont hat. Ich hoffe dass die Marinen aller grossen Staaten bald, dem Beispiele Amerikas und England folgend, Lazaretschiffe bauen werden ungeachtet der Zweifel, ob eine den hohen Herstellungskosten entsprechende Verwendung in aussermobilen Zeiten sich ermöglichen werde. Ich bin nicht aktiver Militärarzt, beschäftige mich aber seit Jahren mit der Frage der Errichtung von Schiffsanatorien, d. h. also Hochseeheilkurschiffen und würde schon deshalb die baldige Errichtung schwimmender Militärlazarette begrüssen, damit das grosse Publikum recht eindringlich auf diese einzigen Möglichkeitsfaktoren zur Ausbeu-

tung der Heilkräfte des Hochseeklimas hingewiesen werde. Entsprechend den ähnlichen Ausführungen des Herrn Generalarztes Stokes durfte ich auf dem vorjährigen Kongresse für Thalassotherapie in Kolberg auch auf die Richtigkeit derartiger Hochseespitäler für wissenschaftliche Arbeiten, für die Erforschung der Physiologie und Pathologie des Hochseeklimas u. s. w. hinweisen. Es bliebe die Erwägung nicht von der Hand zu weisen, ob nicht für die Friedenszeit durch besondere Vereinbarungen diese militärischen Hospitalschiffe grossen Versicherungsbehörden, industriellen Betriebskrankenkassen u. s. w. als Heilkurschiffe könnten zur Verfügung gestellt werden, wie andererseits die hoffentlich bald in verschiedenen Ländern zu errichtenden civilen Schiffsanitorien im Kriegsfalle selbstverständlich der Marine sofort als Lazaretschiffe überlassen werden müssten.

Dr. C. M. Belli, Royal Italian Navy: Je pense que ce que nous avons fait pendant la guerre entre l'Italie et la Turquie peut intéresser la section et je vais vous l'exposer très brièvement.

Sans doute la solution meilleure est de construire des paquebots spéciaux à l'usage de navires-hôspitaux, cependant cette construction ne fut pas jugée convenable de tenir un bateau à veiller sans l'utiliser. On a préféré plutôt d'adapter deux navires transatlantiques à cet usage. Grâce à l'œuvre illuminée des médecins de la marine Rho et Rosati, le matériel de literie, pansements, instruments, médicaments, fut préparé d'avance et était tenu prêt pour l'usage des magasins de l'hôpital de la marine à Spezia. En même temps on a étudié les transformations des navires et on a aussi préparé les cadres spéciaux de mobilisation du personnel médical et infirmier.

Pour cette préparation à l'ouverture des hostilités contre la Turquie, en moins de 48 heures les navires étaient déjà appareiller. Les navires s'appellent *Re d'Italia* et *Regina d'Italia.* Ce sont deux paquebots de 7,000 tonnes avec la vitesse de 14.5 milles à l'heure, construits pour le transport de 1,500 émigrants en deux étages au dessus du pont principal. Ils ont quatre salles, chacune pour 125 lits, chambre d'opération, chambres de pansements, laboratoires de bactériologie, chimie et radioscopie, infirmeries spéciales pour les contagieux et les blessés graves, ambulatoire, pharmacie, chambre mortuaire.

Les hôpitaux sont dirigés par deux officiers supérieurs du corps de santé de la marine (les Professeurs Rosati et Dr. Tacehalti) et ont les mêmes règlements des hôpitaux de la marine dans les ports.

Le but de ces navires est de transporter les malades et blessés en Italie, cependant ils peuvent hospitaliser les malades pour un temps plus long.

Dans les premiers temps de la guerre ils étaient à la suite de la flotte et quelquefois ils ont fonctionné comme ambulances de pre-

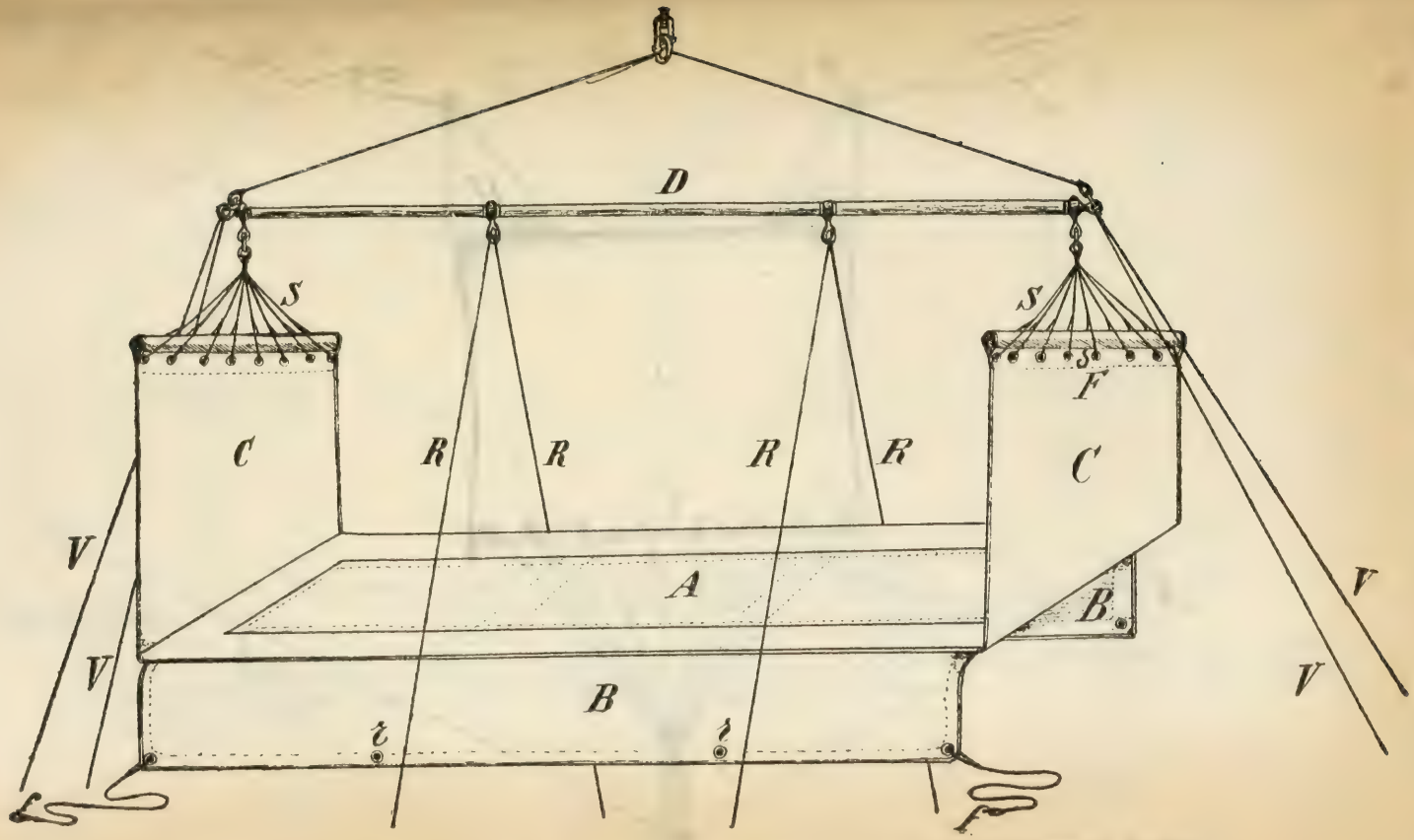


FIG. 1.—Branda inglese colle sponde in tela (B) aperte e in bando e col fondo mantenuto disteso da un telaio.

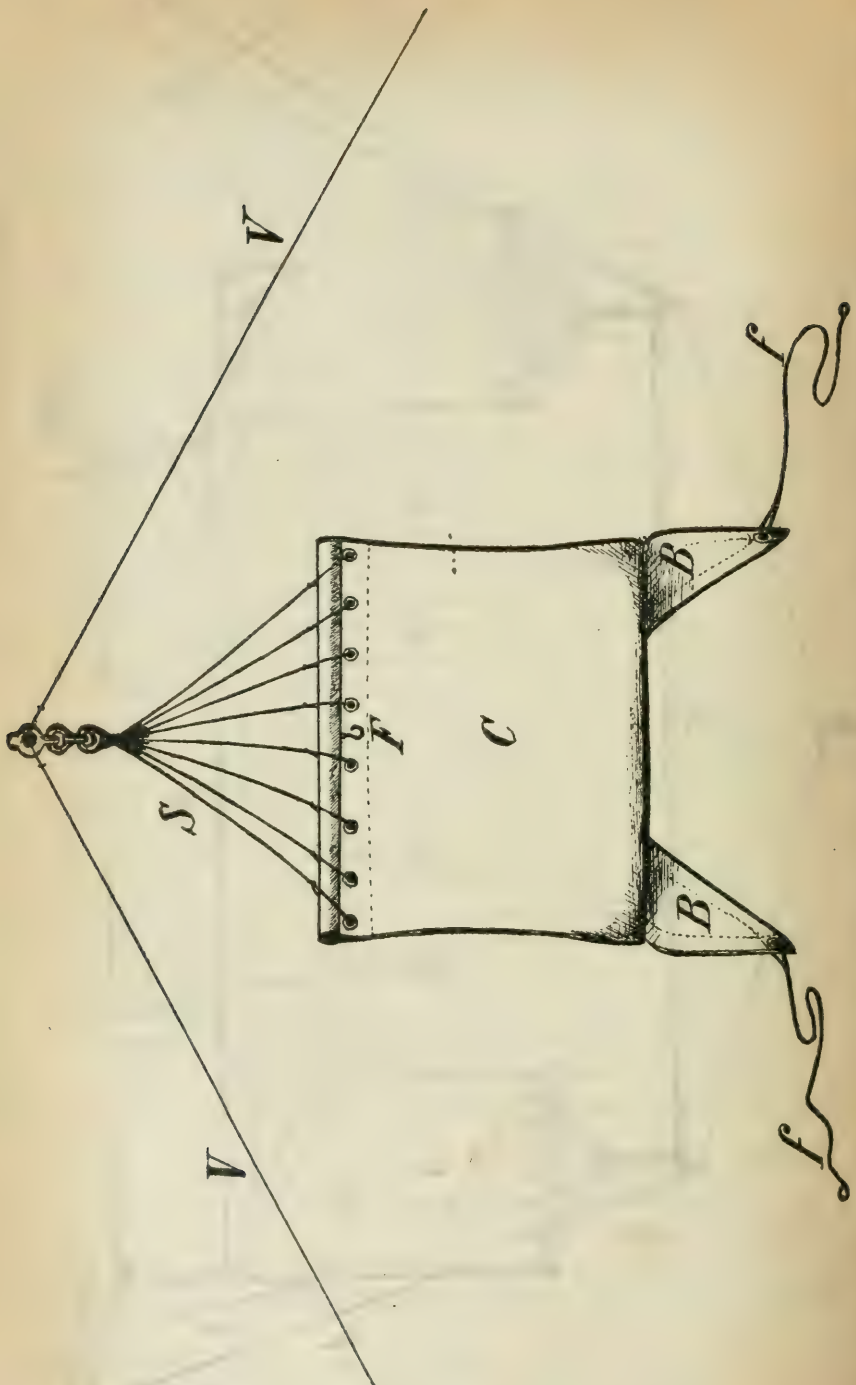


FIG. 2.—Testata della branda inglese nelle stesse condizione col ganzio (F) a cui si assicurano gli occhielli (ff) quando si alzano le sponde (B).

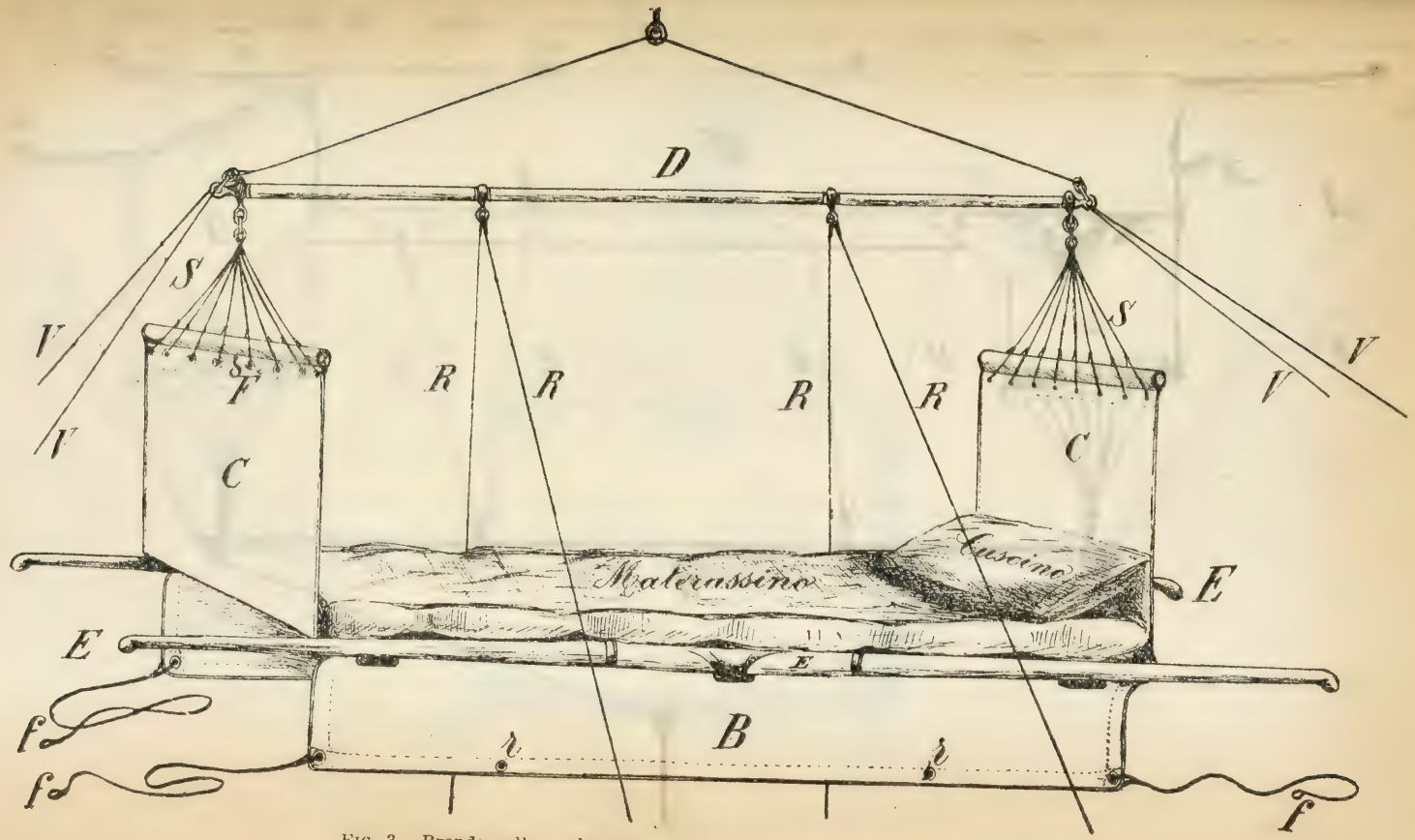


FIG. 3.—Branda nella quale e stata disposta una barella con materassino e cuscino.

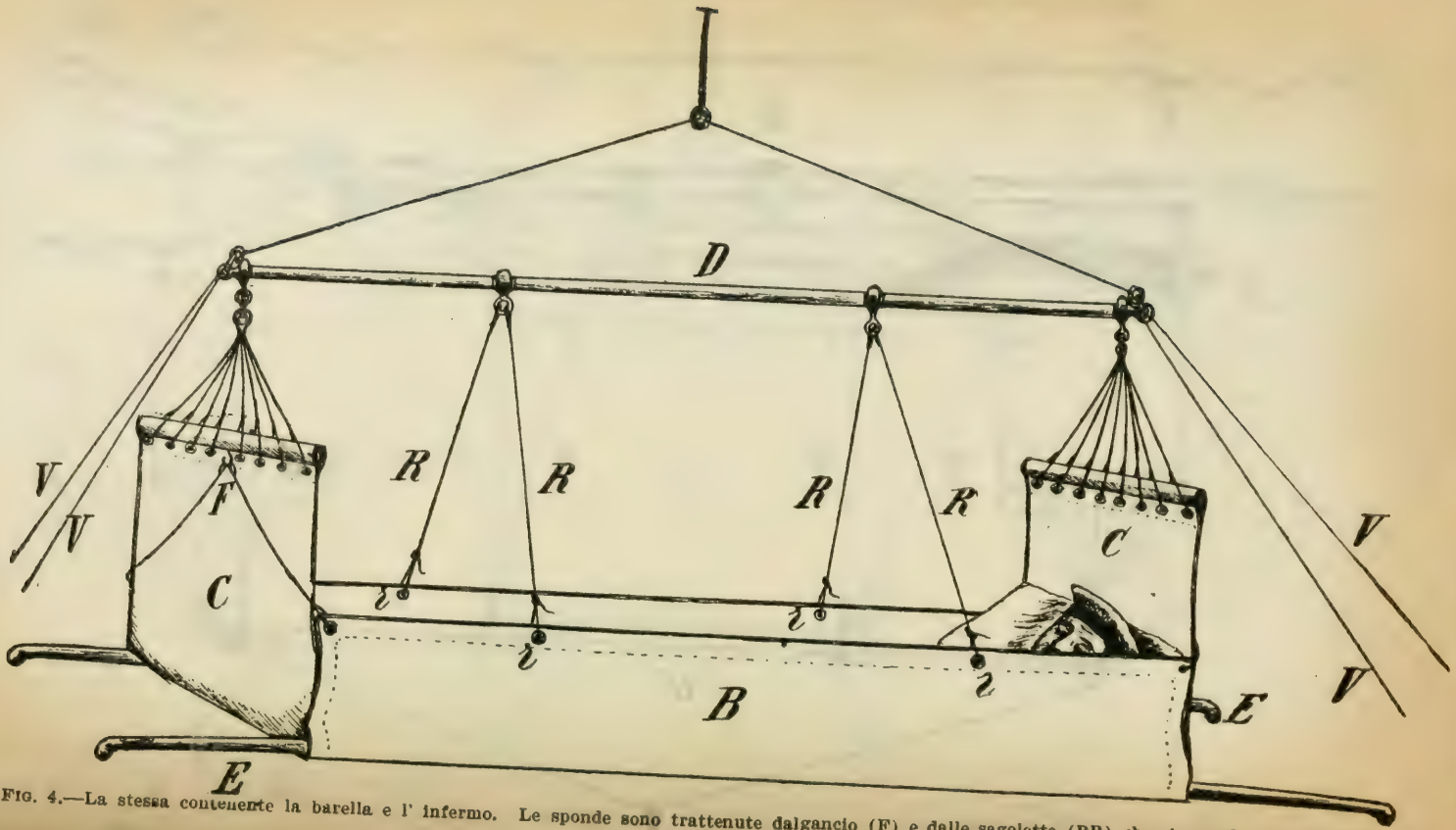


FIG. 4.—La stessa contenente la barella e l' infermo. Le sponde sono trattenute dalgancio (F) e dalle sagolette (RR) che si annodano agli occielli (*rr*).

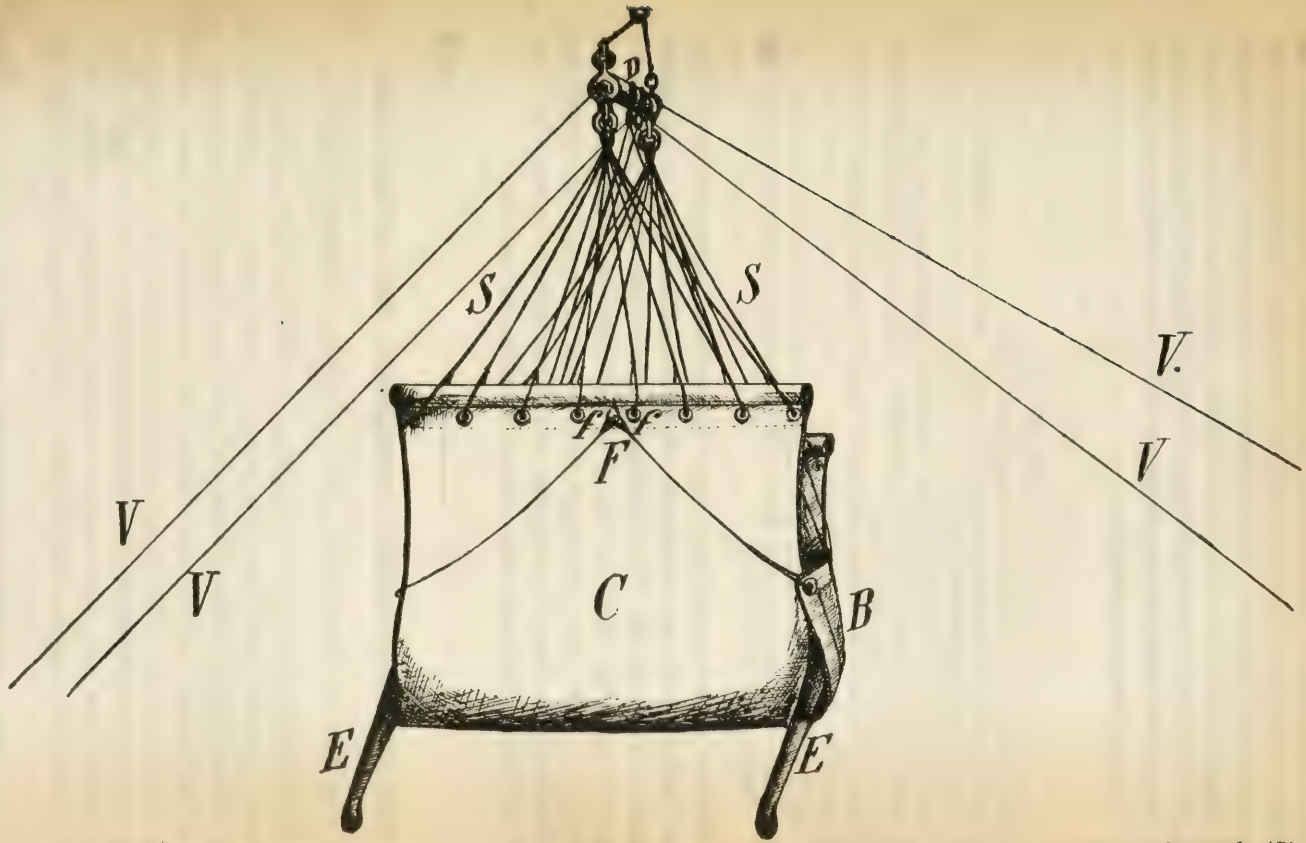


FIG. 5.—Testata della branda chiusa contenente la barella. Gli occhielli (*ff*), sono fissatial gancio (*F*), doporialzate le sponde (*B*).

mière ligne; par exemple, à Bengasi, où à cause de la mer très agitée, les ambulances de l'armée n'avaient pas pu se rendre à terre; à une distance de 13 kilomètres de Rodi ils ont aussi recueilli les blessés du champs de bataille. Maintenant ils servent surtout pour évacuer les hôpitaux de l'armée en Tripolitaine. L'équipage des navires est le même qu'ils avaient auparavant (c'est-à-dire, celui de la compagnie de navigation) et le commandement militaire est tenu par un officier de l'état-majeur de la marine.

LEGGENDA ESPLICATIVA.

[See pages 373–377.]

A. Fondo della branda inglese tenuto disteso da un telaio.
B. Sponde in tela della branda, portano ai loro angoli liberi due cordicelle con occhiello terminale (ff) da agganciarsi in (F).
C. Testata della branda col gancio (F).
D. Asta in ferro a cui e sospesa la branda e che serve ad alzare l'apparecchio.
E. Barella di vario modello e di diverse dimensioni che può essere disposta nella branda.
F. Gancio per tener sollevate le sponde.
ff. Sagolette con occhiello da agganciarsi in (F) quando si alzano le sponde.
RR. Sagole per tener sollevate le sponde.
rr. Occhielli per annodarvi le sagole (RR).
S. Sospensione a 8 fili delle testate della branda.
VV. Sagole o senti per manovrare, girare o immobilizzare l'apparecchio sospeso da qualunque direzione o posizione.

MARINE-GENERALOBERARZT Dr. HOFFMANN, Berlin: Die Frage der Indienststellung besonderer Hospitalschiffe schon in Friedenszeiten wird von den Verwaltungsbehörden der deutschen Marine dauernd in Auge behalten; an eine Verwirklichung des Gedankens wird aber erst dann herangetreten werden, wenn die derzeitigen Vorkehrungen zur Versorgung der Verwundeten nach der Seeschlacht als nicht mehr ausreichend erkannt sein werden.

THE HOSPITAL SHIP AS A PERMANENT UNIT OF THE FLEET.

Fleet Surg. D. MCNABB, R. N., H. M. S. *Hercules*, Portsmouth, England.

In the British Navy the experience of this class of vessel has been limited, and we have been obliged to a great extent to profit by the experience gained in that direction by the navies of other countries.

In the army, on the other hand, the experience has been varied, ranging from the *Victor Emanuel* and *Simoon*, in 1873, to the modern ships used in the Boer War, and the knowledge gained in these ships has made it an easy and familiar work to transform a modern mail steamer of average dimensions into a fairly efficient military hospital ship.

In the navy we have for 10 years enjoyed the benefit of having our own hospital ship, and I speak with knowledge when I say that scores

of officers and men have been grateful for the occasion which placed this ship at the disposal of the fleet, both at home and abroad.

If anything were required to accentuate the necessity for such a ship it could be instantly afforded by the relief to patients, both apparent and expressed, when they exchanged the bustling, crowded living quarters of a battleship or cruiser for the peaceful, well-ventilated ward of the hospital ship, the cramped hammock for the comfortable cot, and, above all, the complete cessation of the noise which is incidental to all naval life at sea.

These 10 years, with the ship at our disposal, have done much to solve the question as to the rôle of the hospital ship as an integral part of a fleet.

We know that before her advent, or before her uses were thoroughly arrived at, the movements of a fleet were sometimes hampered by the number of sick; ships had to be sent back to port when they need not otherwise have left the fleet; the principal naval hospital of a station abroad was choked with sick, and enormous sums had to be spent annually in sending invalids home, while round our own coasts considerable expense was incurred for the care and maintenance of men left in the surgeons' and agents' hands after the visit of the fleet.

Without saying that this condition of things has been eradicated, it may safely be asserted that it has been very materially altered for the better, and that with a ship which was transformed from an ordinary tramp liner and whose accommodation and arrangements left much room for criticism.

The *Maine* had been fitted as a hospital ship during the Boer War by an association of philanthropic American ladies. Her service in that capacity finished, she was returned to her owner. But before any of the fittings had been removed it occurred to him that the ship might be of use to the Navy.

Negotiations were entered into which resulted in the ship making an experimental cruise to the Mediterranean. This was at a time when the scourge of Mediterranean fever lay heavy on the large fleet concentrated on that station. It was at once apparent to most of us out there at the time that there was a very large field of use for the ship. This was in 1901. The ultimate result of these negotiations was that she was transferred to the Admiralty and became part of the fleet.

From 1902 to 1907 she was continually employed in the Mediterranean.

She accompanied the fleet in its cruises and proved of great value in the Levantine ports, those hotbeds of malaria and enteric. She ran back to Malta, discharging cases to the hospital there; visited

detached portions of the fleet; and at times returned to England with invalids.

In 1905 and 1906 the congestion in Malta hospitals was so great, from the incidence of Mediterranean fever in fleet and garrison, that for 18 months the *Maine* was continually employed running to and fro between Malta and England. By the end of that time, thanks to the efforts of the commission, Mediterranean fever was practically stamped out. Also the fleet had diminished in size, owing to a revised concentration of ships, and by 1907 the sphere of action of the ship had passed to the enormous fleet collected in home waters, and there he is now employed.

From this history it is beyond doubt that the ship has more than justified her existence. She has proved the usefulness of a hospital ship accompanying a fleet and providing suitable accommodation, and so obviating the necessity for detaching any unit of that fleet. She has frequently proved her usefulness in cases of accident where operative treatment was required, and where the skill of the medical officer of a cruiser or battleship would have been seriously handicapped by his surroundings. She has proved her usefulness in clearing the base hospital, where the only other means at hand was a crowded man-of-war going home, or the somewhat erratic service of passenger steamers, many of which carried no surgeon.

She has again proved her usefulness in accompanying the fleet to some of the out-of-the-way parts of our own coasts and substituting her accommodation for the poor quarters which are all that are frequently at the disposal of the local surgeon and agent.

If all this can be carried out by a ship which was transformed into a hospital ship in six weeks, then I believe we are justified in thinking that a more efficient service will be rendered by a ship designed and built for the purpose.

The defects of the *Maine* are such as might be expected in a vessel so abruptly diverted from the work she was designed for originally, and come under the heads of structure, water supply, accommodation of nursing staff and crew, ventilation, auxiliary machinery, and speed.

I might give details of this list of defects, but I have mentioned enough to emphasize my point, namely, that if with a ship such as this we have been able to do so much, how much more may we not reasonably expect to do with a ship where these defects have been foreseen and removed.

Now, having finished with defects, let me deal briefly with the ideal ship. No doubt there have been many suggestions with regard to size, speed, and internal arrangements, but it will be sufficient if I

point out what appear to me to be the principal considerations in a hospital ship:

1. WARDS.

(1) The object of the ship being a floating hospital, the design must be such that the general principles governing the conduct of a hospital be given fair play.

The wards must be spacious, lofty, well lighted, and well ventilated, and they should occupy the whole breadth of the ship.

(2) The wards should be easy of access to lifts and stairways; but, if possible none of these should open directly into a ward.

(3) Attached to each ward, or between two wards, there should be a vestibule, and in this vestibule or annex the latrine arrangements should be placed.

(4) All wards should be wood lined to insure a plain running wall free from crevices and an equable temperature for the wards.

(5) Whatever system of ventilation is adopted, it should be so arranged that it is evenly distributed over the ward, and the delivery of fresh air should be near the level of the deck.

(6) In large wards there should be latrine and bath accommodations available at each end.

(7) Cupboard accommodations should be provided in annex for ward clothing, sheets (which should be heated), and the like, and for dustpans, brushes, soap, and scrubbing cloths. The last-named articles in particular should be stowed in the annex.

(8) It is not necessary to have drains for the ward decks, but should they be provided then they should pass directly overboard, being filled with nonreturn valves.

(9) Interior of wards should be painted a light green. Double sets of washable cretonne curtains should be provided for chairs, curtains, and settees.

(10) Mess tables capable of seating one-third of the occupants of the ward should be provided.

(11) Gangways between rows of cots should be made wide enough to allow of service cots being passed along them.

(12) All stairs leading to wards should have an easy tread and should be wide enough to take the service cots. This latter detail also applies to lifts.

(13) Feeding trays to be fitted to each cot.

(14) Under each cot should be a detachable locker for clothes.

(15) Each ward should have in it a plate-warming apparatus, whether the joints are carved in the main pantry or not.

(16) Heating of wards should be by electric or steam radiators.

(17) A sufficiency of easy chairs, deck chairs, and camp stools for each ward should be provided, with washable covers for each.

(18) Separate ward accommodation for lunatics.

(19) Sick officers' mess room should be separated from ward.

(20) Officers' ward; small number of cabins for special cases; remainder in general ward.

(21) Operating room in two parts—preparation room, with sterilizing room leading off from it, and operating theater.

(22) Special ward close to operating room.

(23) All beds should be numbered according to plans of wards.

(24) Cots not to be superimposed, but there should be provision for doing so in case of necessity.

(25) All ports should have green tatties for use in hot weather.

(26) Infectious diseases should, as far as is possible, be provided for on superstructure.

2. DECKS.

(1) The upper decks should be as clear as possible, to allow of patients getting fresh air and exercise. Any motors, capstans, or boat hoists which may be required should be as small and silent as possible, and, where it is avoidable, should not be bedded over ward accommodation.

(2) A permanent light wooden sun deck or awning should cover the upper deck, to obviate the use of canvas awnings.

(3) Shelters for the use of patients in inclement weather should be provided, and, if possible, these should be transformed into smoking places for bad weather.

(4) Boats should be swung out at the level of the awning deck and chocks provided for turning the boats in on that deck when necessary.

(5) Accommodation for male nurses should be quite apart from wards, with suitable arrangements for men on night duty. Separate latrines and bath places should be provided.

(6) Accommodation for mercantile officers to be in close proximity to the bridge, with a separate mess where all would live, with the exception of the master, who would be a member of the naval mess.

(7) Engineers should be accommodated similarly with relation to the machinery and with a separate mess.

3. FEEDING.

(1) The whole messing arrangements for naval, mercantile crew, and patients to be in the hands of a naval paymaster, who could have a chief steward responsible to him for the issue of the provisions, the paymaster being responsible to and rendering all his accounts through the principal medical officer of the ship.

(2) The galley should be on the upper deck and away from the wards.

(3) Separate pantries to be provided for each ward, with food lifts leading into them.

(4) Medical and other naval officers must have a separate mess from the sick officers.

4. EMBARKATION AND DISEMBARKATION OF PATIENTS.

(1) Two embarkation ports might be cut, one on each side, opening into an annex, not into a ward direct, with transporters.

(2) The actual embarkation should be carried out by the mercantile officers, using either their crew or working parties from ships, to man the whips and steadying lines for cots.

(3) All baggage belonging to patients should, if possible, be sent in advance, booked as embarked by the naval police, and stored in the baggage storeroom under their supervision.

5. BOATS.

(1) The number of boats will have to be sufficient to provide accommodation for the whole crew and the invalids, and the boat stations must be arranged jointly by the principal medical officer and the master of the ship.

(2) It seems to me that a useful result would be attained by having several hospital boats specially built for carrying cots and designed for being towed by suitable motor boats.

GENERAL.

(1) The vessel should be well ballasted, both by permanent ballast and by water ballast. The former should be stowed so as not to interfere with easy access to the side and double bottoms of the ship.

(2) Heating apparatus to all parts of ship.

(3) Hospital ship, in war time, should carry complete outfit for hospital marquee on shore.

(4) Ship should carry no one beyond naval and mercantile crew and the sick.

(5) The cleaning of all wards and nursing staff's quarters should be the duty of special ratings, and not the sick-berth staff.

(6) A decompression chamber for dealing with cases of caisson disease might with advantage be added to the equipment.

Hospital ship as an integral part of a fleet in (1) peace or (2) war.

PEACE.

In peace time, the duties of a hospital ship would be to accompany the fleet to which she is attached on all cruises in company when the fleet is away from the bases containing shore hospitals and to perform for that fleet all the duties which are nominally undertaken by the home hospitals.

When making a passage from one port to another the hospital ship would either accompany the fleet or make her way independently, as the commander in chief might determine, her wireless telegraphy rendering her easy of acess in case of need.

Only urgent cases need be transferred at sea, and this could only be done if the weather allowed, and could be carried out by the special boats borne on the hospital ship.

On arrival in harbor, the number and nature of cases to be sent from each ship would be signaled from the flagship and the routine for their reception on the hospital ship set in motion.

This routine is a matter of detail, but it is essential in a hospital ship that she should always be in a state of preparedness, and it is only by the establishment and practice of a definite routine that the business of the ship can work smoothly.

It refers to the preparation for embarkation, the embarkation, the conduct of the patients on board, and the disembarkation.

The preparation includes reviewing ward inventories, testing electric fittings, seeing that latrines are in proper working order and fresh-water supply efficient, that beds and hospital clothing are prepared, and tallies with the spun yarn attached to each bed for making and identifying bundles of clothing belonging to the newly received patients.

Telling off beds for patients from nominal list provided in advance, if possible; roughing out requirements of diet; and getting supplies of milk, soda, and ice ready. Lifts should be tested. Ward tickets are prepared from nominal lists.

All beds in the ward should be numbered, for many reasons—for identifying cases, fixing stations for patients, and so on.

Embarkation.—Approach of boats with patients notified by signalman on watch. Cot carriers slung out and worked by deck officer of hospital ship.

Cases told off to wards by ward master from prepared list.

Ship's corporals supervise the stowing of all baggage and entering of it in baggage book. In the case of helpless patients, the working party coming with the patients is responsible for the stowing of gear. All valuables collected and booked by paymaster and his staff.

As soon as possible after arrival on board a statement of the previous history of each case is copied into the front page of the ticket of each patient and the scale of diet arranged.

Routine while on board.—As soon as patients are settled down they are told off the fire stations and stations for abandon ship, special arrangements being made for the care of helpless patients to their places in boats.

The patients must be made acquainted with the rules as to smoking, the hours of being on deck, and the parts of the ship to which they are not allowed access.

Care has to be taken that patients do not interfere with the essentials to the safe navigation of the ship.

The comfort of the patient is the first consideration, and every effort must be made to check unnecessary noise and to have machinery, such as capstans, boat hoists, and winches, working as quietly as possible.

Plans of boat stations should be shown in each ward.

Disembarkation.—All papers in relation to this are prepared the day before. Incidentally, all papers coming with patients are taken to the paymaster first, who checks and registers each. Likewise, before leaving, all documents going with patients are checked and registered by that officer and his staff.

Valuables are taken over by the medical officer in charge of disembarkation and are signed for by him.

As previously pointed out, these are matters of detail for the medical officer in charge of the ship, but it can not be too strongly insisted on that the ship must, while with the fleet, be always prepared to embark any number of patients up to the full complement.

As a rule, ships sending cot cases to the hospital ship should send a working party of men to assist in getting the cots to their respective wards.

Whether the cots are embarked on the top deck or through baggage ports in the main or lower decks, it is desirable that there should be a system of overhead tramway with a traveler by which cot and cot carrier could be run into the ward from the point of embarkation.

Of necessity, it will happen that the supply of provisions for the hospital ship will be entirely independent of the victualing of the fleet.

The matter of the victualing of the ship is in the hands of the paymaster, and sufficient stores of all kinds to last at least three months should be provided in cold storage.

There should be no necessity for the bringing of fresh food into the ship, and if, for any reason, this should be done it must be only with the special approval of the principal medical officer.

A good reserve of ice should always be in hand, in case of a breakdown of the ice-making machine, supposing that there is not an extra machine on board.

Efficient mosquito nets should be supplied to all beds. Mosquito-proof scuttles, doors, hatches, and ventilators are also advisable, if the ship is liable to visit malarial ports.

Fire stations and abandon ship should be carried out once a week, and boat exercise monthly at least.

While in harbor an efficient gangway watch should be provided, partly by the mercantile crew and partly by the naval (ship's corporals), to prevent the access of unauthorized persons to the ship and to check leakage of stores.

In case of an epidemic of infectious disease breaking out in any ship of the squadron the hospital ship should be in a position to supply the equipment necessary to form an isolation camp.

This would consist of a marquee capable of holding 30 cases. Six bell tents, capable of holding 6 men each, tents for medical officer in charge, the sick-berth staff, and a guard tent.

Staff for 30 cases: One medical officer, 1 dispenser, 5 sick-berth attendants, 1 cook.

The camp would be pitched on some convenient spot, an island for choice.

Every effort should be made to throw the clinical material of the hospital ship open to such medical officers of the fleet as would wish to make use of it, always provided that this were done subject to the authority of the principal medical officer and without disturbing the routine of the ship.

WAR.

The duties of the hospital ship in war time, in addition to those performed in peace, also comprise dealing with the eventualities peculiar to a naval action.

The circumstances under which these latter will be met and dealt with depend on (A) whether the fleet is making a passage with the object of intercepting and fighting the enemy in the open sea, (B) whether the fleet is operating in narrow waters in proximity to its base, or (C) whether the fleet is taking part in combined naval and military operations on the enemy's coast line.

(A) Assuming that an action takes place in the open sea at a distance from a base, the only pretext which might induce a hospital ship to approach the fighting zone would be found in the desire to clear the wounded from a battleship or cruiser which, owing to damage, had hauled out of line and was in danger of foundering; but as such a disabled vessel would be the legitimate prey of the enemy's destroyers or cruisers the approach of these latter would, I suppose, be the signal for the withdrawal of the hospital ship.

The fight being over, the next point for consideration is how to relieve the fighting ships of their wounded as speedily as possible. As the action has been assumed to take place in the open sea, away from any available base, it follows that the transfer of wounded must take place at sea. In this I am assuming that the hospital ship is with the victorious fleet, because, in the event of a defeat, in the first place, there would not be much left to give assistance to, and, in the second place, the hospital ship would come under the direction of the victorious commander, who would be entitled to use her for his own wounded.

The methods for carrying out this transfer will be suggested later on.

(B) In the second case the fleet has been assumed to be operating in narrow waters in proximity to a base, or a place which could be used as a temporary base. In that case it would seem reasonable to suppose that the hospital ship remained at that base during an action, and that after the action such ships as were not employed in the immediate chase of the scattered enemy should return to that base to disembark their wounded. It might easily happen that the whole fleet would be employed on this duty of chasing the enemy, in which case the hospital ship could follow it, taking the wounded on board at the first opportunity.

In one or two of the fights off Port Arthur the Russian hospital ship accompanied the fleet and returned with it to its base, but in this case the object of the Russian fleet was to escape from Port Arthur as an intact fleet with all its auxiliaries, and this object being defeated by the Japanese the hospital ship was obliged to return with the fleet. The Japanese never brought their hospital ships with them; they remained at the base at the Elliott Islands.

Most probably, as was the case with the Japanese, as far as I know, in addition to the hospital ship there would be present at the base "carriers"—that is, converted transports or mail steamers. The cases which could bear an immediate voyage would be sent to these carriers, while the more serious cases would be retained in the hospital ship until they were in a better condition to undergo the voyage.

(C) Lastly, where the operations are of a combined nature it would appear natural to suppose that where bluejackets or soldiers are landed means will be at hand for the embarkation of the wounded.

METHODS OF TRANSPORTING SICK AND WOUNDED TO HOSPITAL SHIP.

Having outlined the functions of the hospital ship in peace and war, I now wish to offer suggestions on the best means of bringing the patients alongside the hospital ship under the varying conditions hinted at above.

I have divided the subjects as follows:

1. From ship to ship: (*a*) In harbor or in a sheltered anchorage; (*b*) in the open sea.

2. From shore to ship: (*a*) Good harbor for ships, with embarking facilities; (*b*) open anchorage with small camber for boats; (*c*) river mouth, navigable for boats but not ships; (*d*) open beach; (*e*) open beach with surf.

1. (*a*) The transfer could be made by special hospital boats carried by hospital ship and towed by motor launches. These boats should be of the following design:

	Feet.
Length	36
Beam	10
Depth (ceiling to deck)	5
Draft	3

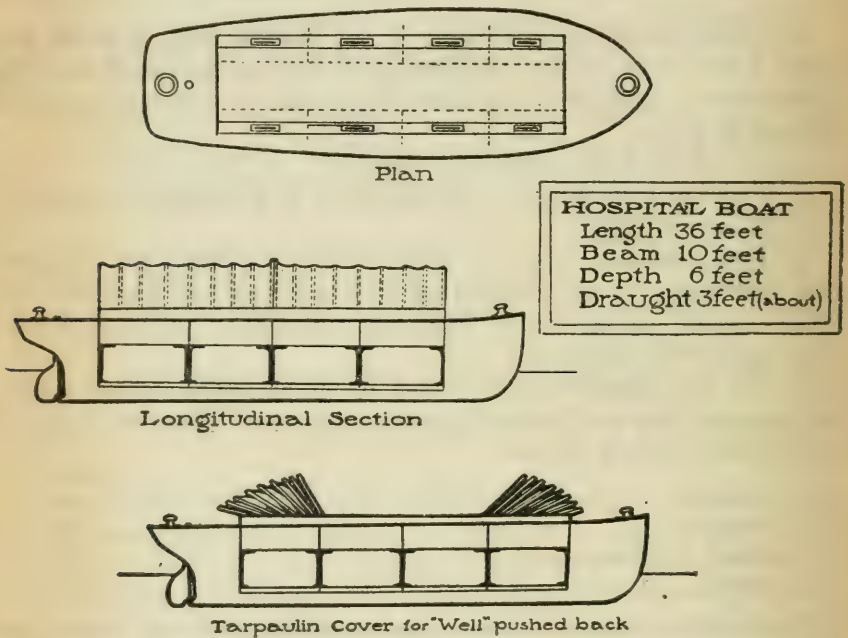
Decked in, with a well 24 by 4 feet amidships, this well surrounded by a coaming 1 foot 6 inches in height. The well should be covered with a tarpaulin carried over galvanized-iron spreaders of a height of 2 feet above the coamings of the well. When this is opened the tarpaulin is rolled or pushed back (concertina fashion, the spreaders being made to travel along a rail fitted on the outer side of the coaming).

The interior of the craft should be fitted to carry 16 cots, 8 on a side, superimposed, with a gangway amidships of 3 feet 6 inches. When in use the boat should carry her complement of cots, with or without bedding.

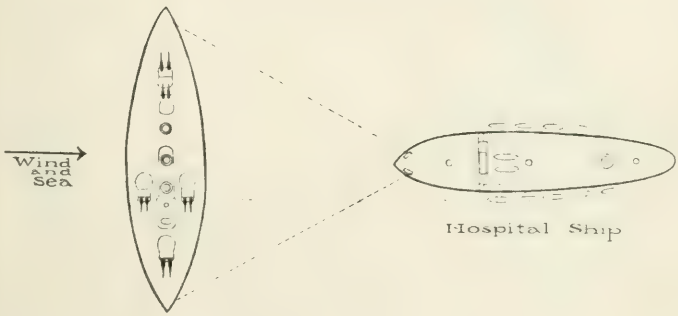
The cots being embarked, the tarpaulin and spreaders (which are in two sections, one forward and one aft) are drawn together and

clamped amidships. The after end of the tarpaulin should not be laced down, but should hang loose like a curtain. The boat or boats can then be towed to the hospital ship, and the cases embarked in the usual way by means of cot carriers and cranes.

(*b*) If the weather is calm, the same routine as above may be carried out. However, if there is a heavy sea, then the matter becomes more difficult; but, subject to the criticism of experts, I would suggest the following proceeding: The hospital ship should approach the fighting ship end to end on her starboard (or port) beam, passing to leeward, assuming that the fighting ship is lying broadside on to the sea with engines stopped. A buoyed line could be dropped from



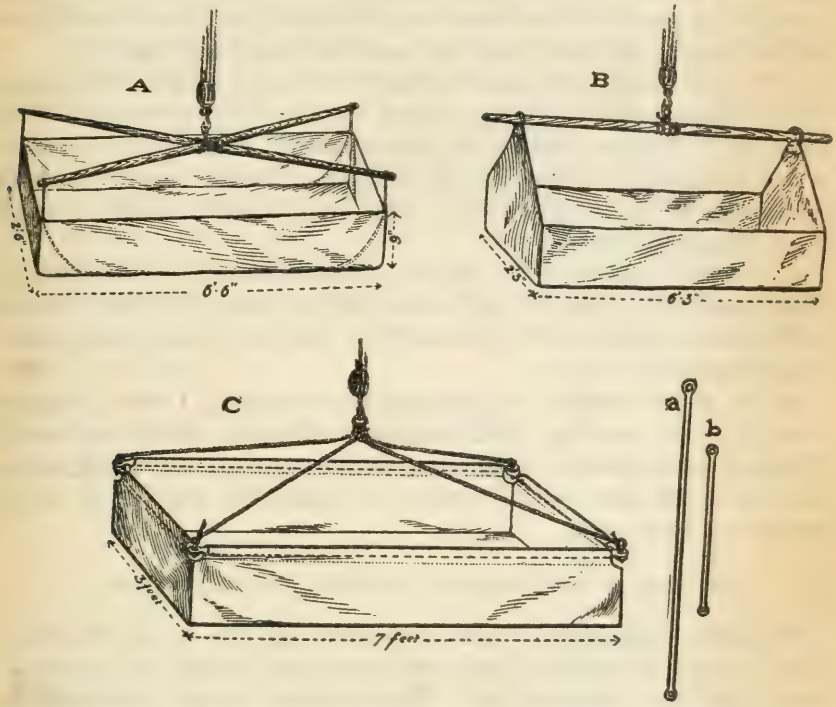
the fighting ship's forecastle and picked up by the hospital ship, and by this a hawser run from her starboard bow to the fighting ship's forecastle, and, by a repetition of the process, from her port bow to the fighting ship's quarter-deck. The hospital ship would then be using the fighting ship as a sea anchor. Under the lee of this sea anchor, one or more of the hospital ship's boats could be hauled up alongside the battleship, loaded up, and dropped back to the hospital ship; the operation being repeated as often as required. Oil might be used from the battleship to minimize the breaking of the seas. The ships might be kept apart by the hospital ship going gently astern during the maneuver, and so keeping a slight strain on the cables.


Wind and Sea
Hospital Ship

This is not a matter which can be dogmatised upon by the medical officer, but, such as it is, I offer the suggestion, and if it is practicable, then so much the better. (Plans I and II.)

2. Next comes the question of the embarkation from shore to ship.

(*a*) Where embarking facilities are good, with the boats available from the hospital ship, the operation should present no difficulties.



C. A canvas cot carrier, 7 feet by 3 feet by 1 foot 6 inches deep. The tops of all four sides are turned over and sewed, so as to form sleeves, open at each end. Through these sleeves metal rods (of length proportionate to the sides and with the ends turned to form rings) are rove. The two adjacent rings at each corner are hooked to a screw hook at each end of the two strops. Each strop has an eye in the middle. These two eyes are brought together and hooked onto the block and tackle for lifting the carrier. The metal rods or spreaders keep the carrier rigid. When not in use they can be withdrawn and bound together, and the canvas rolled up. Thus the apparatus occupies very little space.

a. Metal spreader, 7 feet 6 inches long, over all.

b. Metal spreader, 3 feet 6 inches long, over all.

(*b*) Where there is a small harbor, camber, or pier, with an adjacent anchorage for the hospital ship, the same routine may be followed as in 2 (*a*).

(*c*) Where there is no camber or pier, but a river navigable for boats, then the hospital boats may be brought in and loaded from a temporary pier or floating stage, or by wading in with the cots.

In a muddy river or estuary, a temporary landing stage could be constructed by a series of rafts or pontoons anchored and connected by gangways, the stage reaching out far enough to allow of the boats being loaded at all states of the tide.

(*d*) *Open beach, no surf.*—Temporary landing stage, if one is available; if not, the boat must be veered in as far as possible and loaded by hand. If the beach is steep-to, or there are rocky ledges available, a pair of sheer legs would probably be found useful for landing stores, and these could be used for embarking cots.

(*e*) *Open beach, with constant surf.*—In this case it would be better to rely on some local type of boat manned by men accustomed to the work. Apropos of this may be mentioned that there is a model of an ambulance surfboat in the British Museum, which seems to meet with all the requirements. The originals were used at Cape Coast Castle in 1873.

The boats were built by Messrs. Forrest & Sons, at Limehouse. They were 25 feet long, 5 feet broad, with a draft of 2 feet 3 inches.

They were whaler built, manned by a crew of 12 men, and carried 24 passengers and 2 cots.

As far as the hospital ship's boats are concerned, I would suggest that all boats carrying sick (except surfboats) should be towed. This leaves the whole of the space in the boat to be devoted to the stowage of the sick in their cots and lessens the number of hands required in each boat.

METHOD OF GETTING SICK AND WOUNDED INTO BOATS.

The many appliances which have been and are in use on board ship are no doubt suitable, and have been found useful, for the special duties they were designed for. These articles consist of hammocks, carrying cots, stretchers of the ordinary service pattern, and of special design, for slinging, sleighs, and cot carriers.

When it comes to disembarking wounded from a ship, most stretchers may be put to one side, not because they can not be slung over the ship's side, but because of the difficulty of stowing them in the boats, and also because they are probably not numerous enough. Sleighs, also, are not easy to stow, and their great weight makes them unhandy.

It comes to this, then, that hammocks and carrying cots are the most likely to be of use; and, especially in cases of emergency, I can see a great field for their use.

Lastly, cot carriers as at present in use are heavy wooden frames made to carry the ordinary cots and suspended from a wire strop by four wire slings. In my opinion this is too heavy and clumsy, and it can not be carried in an ordinary hospital boat.

I would like to suggest that the cot carrier be made of stout No. 1 canvas, with sides, the corners being specially strengthened with double canvas and the holes slung by eyelets at the corners from four slings, these slings being in turn suspended from the four arms of two light spars lashed amidships diagonally. The whole could be lifted by a tackle made fast to a strop passed around the spars where they are lashed. A carrier such as this could easily be carried in each hospital boat. (See Plan IV, A; also Plan V.)

Now, suppose that a hospital boat comes alongside a ship with her complement of empty cots and the cot carrier. The cots are at once passed on board, either by hand or by means of the cot carrier. The patients are quickly placed in the cots, with their own bedding, if there is none in the cots, the cots lifted into the carrier, and the carrier hoisted over the side, lowered into the hospital boat, and emptied, this being repeated until the patients are all embarked. The carrier need not wait for cots. Patients who require it may be lashed up in their hammocks, or may be even laid in the carrier without anything. They can not fall out, and there should be no difficulty in making a rapid transfer.

THE DIMENSIONS, CONSTRUCTION, AND FUNCTIONS OF HOSPITAL SHIPS, INCLUDING HANDLING OF THE SICK.

Medical Inspector GEORGE PICKRELL, United States Navy.

Naval hospital ships in time of war are by no means of recent date, and every naval power of importance has made use of them. The tendency of the day in the naval world is toward the concentration of ships in great fleets with aggregate crews of 10,000, 15,000, 20,000, and even more men. Under such conditions the old method of treatment and care of the sick in the sick bay or "sick quarters" on each ship was lamentably inadequate, unfair to the patient, and a serious menace to the efficiency of the fleet. We will not discuss the necessity for the hospital ship. The naval medical world has for years been engaged in a campaign of education, the object of which has been to demonstrate the necessity for mobile, floating, general hospitals under medical control, as a part of the great fleets, where the sick could be under proper hygienic surroundings, receive special treatment, and have all the advantages to be obtained at a great hospital ashore. That this campaign has accomplished its object is shown by the fact that of the three great naval powers two have such ships in service and the third (England) is now building one. Ambulance ships and medical transports can be hastily equipped for the proper performance of their duties in time of war from the mer-

chant marine, but the hospital ship, to be thoroughly effective in peace and in war, must be designed and built as a hospital ship and nothing else. This paper is a plea for such design and construction of hospital ships.

It is not proposed to submit a design or enter at all into the details of construction, but to give, as the result of my experience as the commanding officer of a hospital ship, what, in my opinion, are the requirements from the viewpoint of the medical officer, so that the marine architect and engineer may embody them in an effective design. We shall therefore discuss the following points:

1. The size and character of the hospital to be installed on the ship.
2. The size and character of the ship best adapted to this purpose.
3. The functions of a hospital ship.
4. The handling of the sick.

THE SIZE AND CHARACTER OF THE HOSPITAL.

As it is our purpose to use this hospital in time of war as well as in time of peace, it is impossible to adapt its capacity to the requirements of both states. We will therefore adapt it to peace requirements and rely upon the expansion of the purely hospital features of the ship itself and such aid as may be given by ambulance ships and transports in time of war. We know our percentage of sick from the statistical reports of the Surgeon General's Office—from 4 to 5 per cent for all causes, of which number 25 per cent are hospital cases—and our hospital must be of sufficient capacity for the requirements of the largest fleet with which it may be ordered for duty. We will therefore consider the personnel as 20,000 and our hospital capacity as 300.

Wards.—Here we must be prepared to treat all manner of diseases except those peculiar to women and children. The wards should be below the spar deck, with the exception of those for tubercular cases and contagious diseases. No ward should contain more than 50 beds. Natural light and ventilation should be as perfect as possible without structurally weakening the ship. An adequate system of artificial ventilation should be installed and an abundance of ordinary electric fans provided for tropical use. The double-tier pipe bunks have not been improved upon for sightliness, cleanliness, and economy of space. No woodwork should enter into the fittings, decks, bulkheads, galleys, pantries, and closets of that portion of the ship devoted to hospital purposes. The screening of the hospital should be as nearly perfect as possible.

The assignment of wards would be as follows:

	Beds.
Medical wards, two in number, 50 beds each	100
Surgical ward, one in number, 50 beds	50
Venereal ward, one in number, 50 beds	50
Receiving ward (for cases of uncertain diagnosis)	10
Serious surgical and medical cases and the moribund	10
Wards for contagious diseases and tubercular cases. Three wards of 20 beds each	60
Insane	5
Sick officers	15
Total	300

Contagious and tubercular wards.—These wards should be placed in the after part of the ship on the spar deck where, whether at anchor or steaming, the wind would not blow in the direction of the rest of the ship. Contagious diseases, when taken aboard, could readily reach these wards without danger of infecting the rest of the ship. These wards should be open near the top for ventilation, with solid shutters for bad weather.

The insane.—There should be at least 5 strongly built rooms, with only one bunk, set apart for the insane.

Reserve rooms.—It would be well to have 10 rooms with single bunks for the very sick medical and surgical cases, and the moribund.

Sick-officers' quarters.—Fifteen rooms with single beds would be adequate. The quarters might very well be arranged as officers' quarters are aboard cruising ships, with mess room and pantry.

Each of these wards should have adequate sanitary water-closets, bathing facilities, and hoppers for the disposal of fluids. The large wards should have a dressing room and linen closets. One large electrically equipped diet kitchen would do for all the wards.

The operating room.—This presents no special problem. It should be on the spar deck, and have an abundance of natural and artificial light, with the sterilizing room, laboratory, and anaesthetizing rooms opening into it.

Ophthalmological room.—A room equipped for diagnosis and treatment of diseases of eye, ear, nose, and throat.

X-ray.—X-ray room with powerful machine, developing room, and cabinet for electrical treatment.

Laboratory.—For bacteriological and pathological work and chemical analysis.

Dental offices.—Two dental operating rooms equipped for the extraction and filling of teeth, the treatment of abscesses, and so on. No laboratory work.

Laundry.—A steam laundry of one and a half times the capacity ordinarily required.

Disinfecting plant.—Modern steam and formaldehyde disinfecting plant for bedding, mattresses, and clothing.

Elevators.—One forward and one aft going from the spar deck to the hold. Forward elevator to be convenient to operating room.

Cold storage.—This is a very important adjunct to the hospital. It should be ample in capacity. Divided into cool storage compartments for vegetables, fruit, and eggs, and cold storage for meats and butter. Milk can not be kept satisfactorily in either. There should be two engines, to insure against a breakdown.

Mortuary department.—Equipped for post-mortem examinations and embalming of the dead. Cold-storage compartment for storing bodies until a home port is reached. Metal caskets for shipment of bodies.

It will be noted that no provision has been made for convalescent patients save a bunk in which to sleep. If the hospital ship is to accompany the fleet, receive all its seriously sick, and return them to the original unit from which received when fit for duty, there will always be a large number of convalescents on hand. These men will be a nuisance, spending most of their time in the wards. They require sunlight, air, and amusement. The most serious defect in the United States hospital ship *Solace* is that these convalescent patients have no space assigned to them save the ward and the very small forecastle deck, which they share with the rest of the crew. In bad or rainy weather they have the ward only. The American battleships have each a band, talking machines, and a moving-picture outfit. Why can not the sick have these amusements also? Only it would be well to substitute string instruments for the brass band. There should be a large room for playing games and for smoking in the daytime and for concerts, dancing, or moving pictures at night. A library, with reading and writing rooms, and a properly equipped gymnasium would be of great benefit. In time of war these spaces could be utilized for beds, materially increasing the capacity of the hospital. In addition, space must be allowed for quarters, mess rooms, and galleys for the officers of the ship, the officers of the hospital, the crew, and the hospital corps, and suitable offices for the proper conduct of business. There must be storerooms for the various messes, baggage rooms, and space for ship's stores and for hospital supplies.

THE SIZE AND CHARACTER OF THE SHIP.

British and German medical writers have recently discussed this subject. The British surgeon, McNabb, advocates a vessel of from 3,000 to 4,000 tons displacement, with accommodations for from 240

to 340 patients. The German surgeon, Verth, advocates a ship of from 5,000 to 6,000 tons, and a bed capacity of from 250 to 300. The British admiralty is now building a hospital ship to be of 5,000 tons displacement, with accommodations for from 260 to 330 patients. Doubtless accommodation for 260 patients can be provided, without sacrifice of hospital equipment, in a ship of 5,000 tons displacement, designed and built for the purpose, and with all of her space utilized; but the writer, who equipped the hospital ship *Solace*, of 5,700 tons displacement, converted from a mixed passenger and freight steamer, found difficulty in finding space for 200 beds. Small ships are too lively in a seaway, and the equipment too costly for the accommodation furnished. It would seem, then, that the ideal ship should be of from 10,000 to 12,000 tons displacement, with accommodations for 300 patients in peace, and so designed as to expand to 500 beds in time of war, built on broad lines so as to be as stable a platform as possible, and of a speed not to exceed 15 knots. Great speed, even though desirable at times, could never be advocated, for the increase in the number of the engine-room force required, for whom quarters would have to be provided, and the great consumption of fuel, would be prohibitive. The steaming radius of the ship must approximate that of the fleet of which it is a part. Probably the problem uppermost in the minds of those who have to do with these ships at the present time is how to dispense with coal as fuel. A ship of 5,000 tons, to be effective, must carry in the neighborhood of 1,000 tons of coal. The time required to take on this amount will vary, according to circumstances, from three days to a week. During this period your hospital work will be suspended, the operating room, X-ray room, dispensary, laboratory, and dental rooms closed and shrouded in sheets (coal dust has left nothing untouched); then comes a cleaning period outside and inside, including the patients, of about 3 days more. Imagine a great hospital ashore shutting down from 6 to 10 days, and then as long as any of that coal is aboard the fireroom force will track it about the ship and render their living quarters unsightly. Oil must supplant coal as fuel; oil burners must take the place of our coal furnaces, or we must adopt the internal combustion engine. The Diesel type is now in use in ships of 8,000 tons, and appears to be commercially satisfactory. Perhaps the best plan would be to use a combination of the two—the Diesel engines for propulsion, and the steam boiler, with oil burners, for distilling water, running the auxiliary machinery, and for heating, cooking, and disinfecting purposes. The latter plan would greatly economize space and reduce the fireroom force, giving more room for hospital purposes.

THE FUNCTIONS OF A HOSPITAL SHIP.

The hospital ship should cruise with the fleet and is simply a mobile general hospital. She should in times of peace receive and treat the sick, the injured, and the insane confided to her care. If at any time her facilities are overtaxed she may seek relief by running to a base hospital, if one is in convenient reach, or the conditions may be such as to enable her to relieve her congestion by establishing a field hospital ashore. Proper tentage and equipment are among her stores. Her laboratory, eye, ear, nose, and throat, X-ray, and dental equipment, and disinfecting plant are not entirely for use of the hospital, but for the benefit of the entire fleet, and any work of which these departments are capable will be undertaken at the request of any medical officer. The ship should have a comprehensive medical library for the medical officers of the fleet; a limited number of books being issued for a specified time on a proper receipt. When in port, out of the abundance of material on hand, clinics, medical and surgical, should be held at least once a week, and the medical officers who attend may have the opportunity to see how the cases they have sent to the hospital have progressed. In addition to her own hospital supplies, the ship should be a medical supply depot for the fleet, and issue from time to time on properly approved requisitions such medical stores as may be needed. Incidentally, the ship would be peculiarly well adapted to render assistance in great national and world catastrophes. In time of war, the only difference in the duties of the ship would be the rescue of the men in the water and from sinking ships during a battle. After the battle, if there should be a great number of casualties, she, along with the ambulance ships, should hasten to a base hospital and, when relieved of her wounded, return to the fleet to resume her routine duties or to assist at another engagement.

THE HANDLING OF THE SICK.

This comprises the transportation of the sick from the ships of the fleet to the hospital ship in port or at sea, the manner of getting them aboard, and carrying them to the proper wards; also the discharge of patients at a base hospital. Of course, in port this is a very simple matter. Practically at no time is the water so rough that the larger ship's boats can not come in safely with their burden of sick to the gangway, where two or more hospital corps men receive them, bring them aboard, and deposit them in the forward or after elevator, as the case may be, for delivery to the ward. At sea there are times when the transportation of the sick is impracticable; there are more times when such transportation is practicable. The gangway route is unsafe, owing to the liability of the boat being caught under the

gangway, on account of the rolling of the ship, and crushed or capsized. Cargo ports, to be of use, must be within 5 feet or less of the water and are therefore unsafe. For getting the patients safely aboard when a sea is running, some hoisting apparatus is essential. Probably the best of these is known as the "Solace Hoisting Apparatus," a description of which, by Surg. E. M. Blackwell, United States Navy, will be found in the United States Naval Medical Bulletin of October, 1911. By means of this apparatus patients can be safely and expeditiously hoisted aboard from either quarter in any sea in which ship's boats can bring them alongside. Cargo ports are invaluable in still water for the reception or discharge of a large number of patients and their baggage. There should be two, one forward and one aft, on each side of the ship, and all four can be used at the same time. Lighters, tugs, and small boats can come alongside and the transfer of patients and baggage made directly from hand to hand.

TUESDAY MORNING, SEPTEMBER 24, 1912.

THE CARE AND TRANSPORTATION OF THE WOUNDED DURING AND AFTER AN ACTION AT SEA.

CHARLES F. STOKES. A. M., M. D., D. Sc., LL. D., Surgeon General, United States Navy.

It must be conceded that a situation has developed in connection with naval warfare that is not generally appreciated. In the race between ordnance and armor, offense has outstripped defense, and recently efficiency in gunnery has amazed the world; in fact, the head of one great naval establishment has publicly announced that his service is 1,200 times more effective in this field than it was 15 years ago. It is estimated that a single ship can hurl from 8 to 10 tons of metal per minute against the sides of another, and should a division, squadron, or fleet concentrate its fire on a single ship or group of ships the destructive effects would be appalling. It has been estimated that a duel between *Dreadnoughts* could last but 5 minutes, as by that time one or the other would be annihilated. It has been stated that an action between two modern and approximately effective fleets could not last over 30 minutes, for in that time their ammunition would be expended or the ships destroyed. Although it is known that the numbers of killed and wounded during an action at sea have run as high as 50 per cent, still we usually plan for a casualty list of 25 per cent. The grave nature of the wounds of naval warfare will, perhaps, best be comprehended when we study the character of the missiles and other agents causing them. Not only have we to consider the hot, jagged, mutilating shell fragments but secondary missiles that have been set in motion by shell impacts, such as bolts and other bits of metal. Burns and scalds from severed steam pipes are common, and overshadowing all is the menace of powder-gas poisoning and suffocation from smoke.

It will be apparent, from the rapidity of the fire and the nature of the projectiles, that we shall have a rapid accumulation of wounded; a situation not paralleled elsewhere in warfare. The structural features of modern battleships, devised to avert sinking by splitting the ships up into small compartments, cause the wounded to be difficult of access and add materially to the burden of the medical department. The *Titanic* disaster confirms the belief that the unsinkable ship does not exist. The loss of life from drowning in naval war-

fare about equals the deaths from battle wounds, so that those who have escaped the one hazard may be confronted with the other. Such boats as have been kept on board will probably have been shot away, so that unless assistance is at hand a struggle against death by drowning is inevitable in many instances.

A study of conditions in a single ship will make it easy for us to estimate the tremendous responsibilities that will be borne by the medical department in a fleet of 20 or more ships. The character of the injuries and the condition of the wounded call for skilled and ample assistance. The wounds will all be infected, bones shattered, shock and powder-gas poisoning common, and cases of burns and scalds frequent.

A battleship would probably have a casualty list something like the following: Killed, 70 to 80; wounded, 225; of the latter, 150 would probably be helpless, lying about the decks, the others able to care for themselves.

The personnel and equipment of the medical department of a modern battleship could not possibly meet such an emergency. There are on board from 2 to 3 medical officers and 7 to 10 Hospital Corps men, with insufficient dressings and appliances. Not only should the wounded receive early surgical aid, but they should as well receive food and water, and their dejecta should be removed. In the past much attention has been given the transportation of the wounded on board ship, it being deemed wise to collect them at one or more points during or after an action, as, for example, at dressing stations. The scheme about to be outlined does away with much of this unnecessary handling, which must of necessity be performed by the unskilled in a rough, hurried, and harmful manner.

It is perfectly clear that the deficiencies in personnel and equipment in the medical department must be provided for outside the Naval Establishment. To this end a naval Medical Reserve Corps is now being organized. Physicians in civil life are known to be patriotically inclined, but many are at a loss to know how best to serve their country when war is at hand. Their enrollment in the reserve corps would solve the problem. Their daily activities are humanitarian, and in the proposed plan of relief under the Red Cross they would continue to be humanitarian. Medical officers of the regular establishment would have to stand the hazards of battle on their respective ships.

From the foregoing it will be evident that in the naval battle of the future there will be a very rapid accumulation of killed and wounded; for example, in a fleet of 20 battleships probably 5,000 casualties will occur in about 20 minutes; the wounded will be difficult to get at and, in many instances, will be on sinking ships, so

that a prompt removal, while desirable in all cases, may be imperative in some. The grave and varied character of the wounds of naval warfare complicates the problem seriously. It must be thoroughly understood that the responsibility for humanely dealing with this appalling situation does not rest on the shoulders of the medical department alone; it is the burden of the commander in chief, the leader of the fighting forces, as well, and he will be held to a strict account for a failure humanely to deal with this part of his obligations to his flag.

This side of the question has not been generally understood, and in consequence there has been a lack of cooperation between the militant and humane activities that must only lead to a breakdown when actual battle is engaged in.

The writer has devised a plan which provides for the preliminary training of the entire personnel; accords to the wounded early and efficient treatment; prepares them for transport in a safe, sound, surgical manner; effects their rapid removal from the fighting ships, and insures them skilled professional care from the so-called "firing line" until they are finally disposed of at the base. By this method of meeting our humanitarian battle responsibilities unnecessary handling of the wounded is averted, as will be noted, and the care received by them is at the hands of the same surgeons who treated them at the firing line until they are finally disposed of at the base. A recording staff is provided for, so that not only will a list of killed and wounded be promptly available but a continuous record of each case be kept.

To each division of the battle fleet is assigned a medical transport capable of carrying 1,000 wounded. On board these transports officers of the Medical Reserve Corps will be stationed with their assistants, under the leadership of a sufficient number of officers and men of the regular establishment, and provided with an especially prepared equipment. This personnel would be grouped in humanitarian units, thus: For battleship *A* of the first division there would be 15 reserve corps officers and 60 attendants, under the leadership of a medical officer of the regular service. This humanitarian unit would be familiarized with its equipment, drilled in boat work, and instructed in the structural peculiarities of battleship *A*. It would be required to make preparation of the space assigned on board the medical transport for the care of the wounded from battleship *A*.

During a lull or after an action these humanitarian units would be put on board their respective battleships with their specially prepared paraphernalia, there take charge of the wounded practically where they fell, thus avoiding unnecessary handling, and provide for their immediate removal from the fighting ships. The medical

transports could visit in turn the ships of their respective divisions, so that the flow of wounded would be continuous and the fighting ships expeditiously cleared.

The wounded from an individual ship would be grouped in a previously assigned space on the medical transport, remaining under the care of their humanitarian unit until finally disposed of.

The medical transports, with the wounded on board, would then steam to a previously organized sanitary base.

The medical officers and Hospital Corps men on the ships that had been in action would probably not be physically able to attend the scores of wounded, nor is their equipment sufficient for the needs of such an occasion.

The medical transports should be liberally supplied with suitable boats. It is probable that, thus equipped, they might take many persons from sinking ships whose lives otherwise would be needlessly sacrificed.

It is scarcely necessary to state that the medical transports would observe in every detail the articles of the Geneva convention and, thus neutralized, would fly the Red Cross flag.

Our activities in accomplishing results with this battle plan should be grouped under two heads, namely, (1) preparatory and (2) battle activities.

(1) Preparatory
- Personnel
  - *a.* Regular officers and men.
  - *b.* Reserve corps officers and men.
- Equipment
  - *a.* Medical transports
    - Firing-line equipment.
    - Transport equipment.
  - *b.* Sanitary base.

PREPARATION.

PERSONNEL.

The writer believes that every officer and every man should be frequently drilled in first aid, and to this end he has caused in his own service the drills in first aid to be given to all men at least twice a week, the instruction being given by the line officers, the medical officers qualifying the line officers. The writer has devised a "dummy" dressing which is used at these drills. These dressings can be made on board ship, are inexpensive, and may be used repeatedly. First-aid instruction, as thus given, is universal and, as given by their immediate company or divisional commanders in connection with the other military drills, the men take the work seriously.

Medical Reserve Corps.—Only those of high standing in their profession will be enrolled in this corps. They will be instructed in their duties in war, during peace times, by medical officers of the Regular Service, and it is proposed that each should be required in

turn to recruit and train at least 10 men from among his assistants, students, or attendants in civil hospitals who would be willing to serve with and under him during hostilities. It is needless to point out the advantages in spirit, team work, and accomplishment of this plan. This body of assistants or reserve Hospital Corps men might well be enrolled in the Red Cross.

EQUIPMENT.

Medical transports.—Under the Red Cross these ships may be chartered or bought anywhere. As their services are not likely to be long required it is considered wise to charter suitable ships with their civil complement and equipment complete. Large freighters or cattle steamers are well adapted to this use and, as the wounded would in all probability not remain on board more than a few days at most, few changes beyond putting up bunks or standees would be necessary. The hospital equipment in instruments, dressings, Roentgen-ray apparatus, stores, and supplies should be complete.

The medical transports should carry a liberal supply of seaworthy boats in many of which platforms for transporting litter cases should be built. In 1898 I devised an apparatus for effecting a transfer from ship to ship without the use of boats. This apparatus is simple in construction, is inexpensive, and should be in every medical transport. The killed might be transferred in this way, using a light wicker carrier. A space should be set aside for the dead and provision made for embalming.

"*Firing-line*" *equipment.*—This feature of the equipment is the most important, in that its completeness is the best guaranty that the wounded will receive prompt and efficient care and early and safe transport from the fighting ships.

Each humanitarian unit of 15 medical officers and 60 attendants or reserve Hospital Corps men would carry to a fighting ship the following: 600 shell-wound packets, large; 600 shell-wound packets, medium; 1,200 shell-wound packets, small; 60 adhesive plaster reels; 60 tourniquets; 360 basswood splints; 120 dozen safety pins; 60 splint stretchers in nests.

The medical officers will carry their instruments and emergency appliances, such as hypodermic syringes and tablets, chloroform, spirits ammonia aromatic, tincture of iodine, picric acid, and vaseline. Each Hospital Corps man will carry the following: 10 shell-wound packets, large; 10 shell-wound packets, medium; 20 shell-wound packets, small; 12 bandages; 1 adhesive plaster reel; 1 tourniquet; 6 basswood splints; 2 dozen safety pins.

Each medical officer will accordingly have four assistants (reserve Hospital Corps men), one of whom will be a recorder, who will

provide diagnostic tags and necessary stationery and keep the medical history; another will be an anæsthetist; while the other two will assist at the dressings, etc.

The splint stretcher.—This device is by far the most important feature of the equipment, and is the only apparatus known to the writer that splints the whole body or any part and at the same time serves as a litter. It can be used as a sled, carried on its side, be slid up and down ladders, and is readily whipped into or out of small boats by a davit and tackle. Even the head of an unconscious person can be secured in it, and it makes an excellent restraint apparatus in cases of delirium. Many transferring boards and litters are surgical barbarisms, and in all the patient must first be splinted and then placed in the litter. In the case of the splint stretcher all that is necessary is to apply an occlusive dressing to the wound, and the splint stretcher admirably immobilizes fractures of any parts. In two navies a pliable encircling litter with wooden, splintlike supports is used. The writer feels that this type of litter and all others that bind the lower thoracic region should be condemned, as they are based on unsound surgical principles, in that, if the lower respiratory region of a person in shock or collapse is constricted, as would be the case, it would probably kill the patient, especially if he were upended in transporation. It will be noted that in the splint stretcher the upper securing band is high up in the axilla, the lower at the point of the hip, leaving the lower respiratory region perfectly free. This device is noninflammable, does not splinter, stows readily in nests of three, and has given perfect satisfaction in my own service and elsewhere. It does away with the necessity for providing bulky splinting apparatus.

The sanitary base.—While the sanitary base forms a link in the chain of the transport of the wounded between war vessels, hospital ships, and the coast, a detailed description would scarcely be appropriate here, although I have planned in detail such an organization.

At the sanitary base the permanent care of the wounded begins. After they have been taken out of the fighting ships they should remain on the medical transports only long enough to convey them to the base.

BATTLE ACTIVITIES.

The plan in operation.—In the fighting ships the crews are required to bathe and put on clean underclothes immediately before going into battle. While this procedure may not avert infection, it has a very decided steadying effect on the men. The sick should be removed to the medical transports and first-aid dressings served out. At this time it would seem advisable to transfer from the fighting ships to the medical transports all ship's boats that would otherwise have been left in port or cast adrift before going into action.

All hands should wear identification tags. During action it is the duty of the medical personnel in the fighting ships to keep as many men at their stations as possible. Humanitarian activities will scarcely be feasible at this time. After battle these medical officers should seek out the wounded, aided by their respective divisional commanders, comforting them with the assurance that skilled surgical aid is at hand, making ready for arrival of the humanitarian units from the medical transports, and doing such emergency work as is feasible.

The fleet of medical transports, in command of a medical officer of flag rank, is given a station or has a rendezvous assigned by the commander in chief previous to going into battle. This probably will be, and should be, outside the danger zone. After the action, or during a lull, the transports steam with all speed to the ships of their respective divisions, boats are made ready, and on arrival are sent to the ships to which the humanitarian units have previously been assigned. These medical officers, with their assistants and equipment, go on board the fighting ships and treat the wounded where they have fallen, preparing them for immediate removal. As these officers have not been subjected to the stress of battle, they will be well able to carry on their humanitarian activities. In case the battle is decisive, it may be deemed wise not to transfer the wounded to the medical transports, but to convey them to the sanitary base in their respective ships, in which case the humanitarian units with their ample equipment remain on board. The enemy's wounded should be given every consideration possible, provided the welfare of our own men is not jeopardized.

As the flow of boats from the fighting ships to the transports would be continuous, there should be no congestion of wounded at any point and transfer should be rapidly effected. The dead can be transferred by means of the trolley device, thus not interfering with the transfer of the wounded in the boats. On board the medical transports the wounded from individual ships will be kept together and will be under the care of the same medical officers that treated them at the firing line.

The medical transports will then steam rapidly to the sanitary base, placing the wounded on shore and disposing of the dead. The medical personnel will go on shore with their wounded, their places on the transports being filled, if necessary, by a relief personnel from the sanitary base.

As the advantages of this orderly plan of meeting our battle responsibilities, not already pointed out, will be apparent, further comment is unnecessary, beyond emphasizing the elasticity and adaptability of the scheme as applied to the varying conditions of naval warfare.

DISCUSSION.

Fleet Surg. Dr. A. A. Zohrt, St. Petersburg: Behandlung und Transport der Verwundeten an Bord von Schiffen der Kaiserl. Russischen Marine:

(1) Zwei Verbandplätze verlangt; ausserdem mehrere Reservelandplätze. Bei einem Verbandplatz, zeigt die Kriegserfahrung, kann durch explodirende Geschosse derselbe leicht verschossen werden; dann kann das ganze Arztpersonal leicht durch Geschosse und Gasvergiftung ausser Dienst gestellt werden.

(2) Bei uns wird die ganze Mannschaft gelehrt Verbände anzulegen, und Blut zu stillen. Im letzten Kriege wurden fast alle leicht verwundeten, ausserhalb der Verbandplätze verbunden und zwar mit gutem Erfolg. Gasvergiftungen haben an verschiedenen Schiffen stattgefunden.

CONCERNING THE FIRST TREATMENT OF THE WOUNDED IN SEA BATTLES.

Surg. Gen. Dr. A. C. J. Bornemann, R. N., Denmark.

The question of how to treat in the best way the wounded in sea battles is of great importance.

I shall here confine myself to the first treatment.

It is beyond all doubt that the first treatment of the wound is subsequently of vital importance to the wounded. The lack of sensible and quick treatment may influence the course of the wound in a very fatal way, and without exaggeration one may say that the first treatment of the wound very often is decisive for the life of the wounded, or at least for his vigor and later usefulness in public service or in private life.

Let me give a few examples:

If a man is down with a severe bleeding from one of the larger arteries, he will most probably bleed to death unless he be attended to and the bleeding stanched.

If he gets an open fracture, for instance, of a limb, he will easily contract a suppuration, which may necessitate an amputation if the fracture is not quickly set, the limb bandaged, and the wound protected against contamination by a suitable dressing. First aid should therefore be rendered as carefully and speedily as possible, not only from a humane but also from a purely pecuniary point of view, such treatment preventing many sick days and much permanent disablement.

That the State owes it to the persons who risk their life and health to give them as many chances as possible to save their life and vigor,

when wounded in its service, is no doubt universally agreed upon nowadays; and, fortunately, it is in its own interest. This has long been acknowledged, and the aim of the armies of the different countries is, therefore, to apply first aid as quickly as possible, partly by attending to the wounded on the spot at the firing line, partly by conveying them as quickly and as gently as possible away from the firing line to the bandaging place, and thence, when duly dressed and bandaged, to the field hospital. Hence it follows that the different corps of porters are invaluable to armies, and their reliability and good training are of the greatest importance, and everywhere the object of much consideration and much labor.

Many a wounded man who in former days would have been past help is now saved, thanks, partly, to the more "humane" firearms of small caliber, partly to the quick help, without which many even healthy looking wounds would have taken a fatal course.

However, when the question is of the wounded at sea it is impossible to transfer indiscriminately the conditions and methods of treatment from battles by land to naval combats.

The difference is evidently very great, and the conditions for the wounded on board a ship are, in some respects, better; in others, worse. The conditions are better, because the wounded do not come into contact with the ground, and therefore escape the great danger of blood poisoning which the soiling of a wound with earth always presents. They are better, too, considering that help is nearer at hand, than is the case in battles on land, and considering that, as a rule, naval engagements are not of long duration. But they are worse, since during the battle it will often be quite impossible for the small surgical staff, and the equally quite inadequate corps of porters, to rescue the wounded under fire, so that these will have to wait until the end of the battle.

Let us imagine a man-of-war in action. All water-tight doors are closed. The crew is dispersed in different compartments, isolated the one from the other. Very soon after the beginning of the battle everything on and above the deck will be shot away. To carry the wounded across the deck will be impossible, not to mention the extreme peril of such a proceeding. In the larger ships a transport of the wounded to the lazaretto might perhaps be possible below the armor deck. In this case the doors would have to be opened successively. Still, I doubt the possibility of establishing a really effective transport.

How matters stand in a very large man-of-war of one of the big navies I can not say, as I have not sufficient experience in that respect; but from what I have read about sea battles in recent times I have got the impression that the weaker ship at all events gets so damaged from the antagonist's fire that a regular transport of wounded is out

of the question. But at least in smaller battleships, such as the coast-defense vessels which constitute the Danish Navy, such a transport would be impracticable. The wounded must remain where they fall and wait for help till the engagement has come to an end. And, turning our mind to the smallest ships, the destroyers and the torpedo boats, it is evident that surgical help for the wounded is out of the question, as no surgeon is on board.

Thus, enough situations can be imagined in the course of a present-day naval engagement in which the wounded must remain where they fall till the end of the fight. But of course they must not be in the way of their unwounded shipmates, who go on fighting and who must have room to work the guns, so the wounded must be moved within the bounds of their compartment to places where they will be out of the way. In all likelihood this can not be done by the corps of porters alone, as this body of men can hardly be distributed profitably among all the different compartments of the ship. Consequently, the wounded must be left lying about and run the risk of suffering unnecessarily and of bleeding to death. This state of affairs we must, if possible, remedy, and I think we can do it to a certain extent.

During the Russo-Japanese War one-half of the Japanese crew was, so far as I remember, trained in first aid (*Samaritergerning*) and sick transport. I think this idea splendid, and I do not doubt for a moment that it was of great utility. But I certainly think that it is unsatisfactory to do things by halves, and that is why we have, since 1907, introduced into the Danish Navy the training of the whole crew—officers as well as petty officers and men—in "first aid" and sick transport. The officers are trained while midshipmen. They have lectures on this as on other subjects. The instructor is the surgeon attached to the naval academy and to the training ship. The men are instructed by the surgeons, partly in the barracks, partly on board ship.

This is quite easy to accomplish; as a matter of fact, the surgeons on board the ships have, under ordinary circumstances, time enough to spare to take charge of this branch of the instruction of the crew. This is not to be done merely by delivering a lecture from time to time. The surgeon must often, if possible every day, practice or drill—for instance, for one hour—with a small part of the crew, say 10 men, or as many as the service can spare. The surgeons keep a list in which they enter regularly the names of those who have attended the course and the special subject in which they have been instructed. The object of this instruction and of the practical exercises attached to it is only to teach the men how to transport a wounded shipmate as gently as possible and how to apply the first dressing without doing him any harm. The surgeon gives the men a short description of the nature of the wounds they may come across

on board. He must impress on them the fact that the chief danger is the soiling of the wound. That is why so much importance is attached to teaching the men to put on a bandage without soiling it or the wound. Besides, the men must know how to stanch bleeding temporarily, and in order to do that they must have a fundamental knowledge of the circulation of the blood. They must know the difference between an arterial and a venous bleeding, and the different treatments of these bleedings. They must learn how to apply a tourniquet by means of a kerchief and a piece of wood or the like. Moreover, they must practice how to move a wounded man in the gentlest way, without a stretcher or other appliance, using only their arms. They must know how properly to arrange a fractured or shattered limb and how to keep it temporarily in shape with the material at hand—for instance, a sword, a scabbard, or other similar thing. Briefly, they must learn how to get on with what is at hand. I believe that, considering the extension of the boy-scout movement among the youths of all nations, this instruction will be imparted quite easily and naturally in years to come. The young men who have been scouts have learned precisely these elementary things and have learned how to help themselves with the minimum of resources.

With a crew trained in these things it will be possible during a fight to render some assistance in some cases, though of course I am not blind to the great drawback of using combatants as porters and for first aid. But the act of moving a wounded man and of dressing his wounds takes less time than the explanation of it. On the other hand, the wounded must be moved, lest they should be in the way, and it is of great value to be able to do this with the least possible injury to the wounded.

First aid in case of a wound consists nowadays only in covering it with a sterilized dressing. All washing and antiseptic treatment of the wound is postponed (on the other hand it would be as well if the crew bathed and dressed in clean underclothing just before the fight; the dirt that the men acquire during the battle being relatively aseptic, consisting, as it does, mostly of oil and fouling). The wound in itself is aseptic; the point is not to soil it. It is an indisputable fact that shot wounds, for instance, in the articulations, inflicted by modern projectiles of small caliber, which in former days necessitated serious amputations, are now healed smoothly, as long as they are not touched and no liquid comes into contact with them. They need only be dressed with a dry sterilized bandage while the limb in question is kept quiet, because the wounded articulation is fixed with a firm bandage.

I need only mention that in the battle of Plevna 17 injuries of this kind were treated by Prof. Bergmann in the above way; 16 recovered, only the remaining 1 requiring an amputation. One of the

16 was later on shot at Kars; the section surgeon, who knew about the former injury to the knee, opened the knee joint and in it found a piece of cloth from the man's trousers with dust from Plevna on it. This piece of cloth had given no trouble at all. Of course, matters stand otherwise when the wound is produced by a shell. In this case conditions are, as you know, much more complicated; but here, too, the wound must be treated " dry " to start with. To make quick temporary bandaging possible, every man ought to have a properly sterilized bandage with him. This has long been done in the armies, and should be done in the different navies, too. But here a difficulty arises; for it may not be easy to find a proper place in the men's garments in which to carry the bandage. A pocket may, however, be provided in the upper garment in which the men may place the dressings which the surgeons give them just before the engagement. It is admitted that the men are inclined to cast off their upper garments, but then these are on the spot and thus the dressings can be got at immediately. Besides, the question is worthy of consideration whether the men should not be dissuaded from casting off their upper garments, for from experience gained in recent naval warfare it appears that the men who keep their garments on during the fight have a much better chance of escaping serious burns and scaldings (as a result of explosions, burstings of steam pipes, etc.).

Besides the parcel or bundle that every man has to carry with him there should be deposits of dressings in all places where many men are gathered together. The sterilized dressing used in the Danish Navy is recommended by Dr. Oscar Bloch, professor at the University of Copenhagen. It consists of four compresses of gauze, a piece of waterproofed cotton wool, and a bandage. The whole is packed in two sheets of (filtering) paper and sterilized. When this dressing is kept in a dry place it remains sterile for an unlimited time. Of course the outside piece gets dirty, but the inside wrapper protects the contents completely. The dressing is arranged so that it is ready for use immediately the cover is removed; the compresses which are to be used directly on the wounds being outside, and vice versa. The bandage which is to keep the dressing tight is innermost in the packet. Thus the dressing is put on in a moment. However, the dressing must be so arranged that it will not be spoiled by the men's perspiration in the heat of the fight, when they carry the dressing with them; therefore, after having been sterilized, it must be surrounded by some waterproof material.

Where should the surgeons be during the fight? This question is not easy to answer. Some may think that they should stay in the lazaretto ready to receive the wounded, but, as I have said above, I do not think that many wounded will be able to get to the lazaretto during the fight. Others think that the surgeons ought to be dis-

persed all over the ship, wherever the men are numerous, in order to help and dress the wounded on the spot. In that way, however, they are much more likely to be killed than if they stayed in the lazaretto. My opinion is that the surgeons and their immediate assistants ought to stay in the lazaretto during the whole fight, while the lazaretto itself must be established in the best-protected part of the ship. There is nothing to prevent a subordinate surgeon being placed in another part of the ship, where he can establish a temporary or detached dressing place, if he thinks that a sufficient part of the crew can get to him during the fight; but I think, as stated above, that the greater part of the medical staff should remain together in the lazaretto. They should there treat the wounded who are brought to them, and not begin their more serious work until the fight is over, when the wounded can be found and brought to them for treatment.

Taking it for granted (1) that there will be no question of regular sick transport during a naval engagement, and (2) that during the fight the surgeon will only be able to attend to the wounded to a limited extent it seems to me necessary to attach importance to the instruction of the whole crew in first aid, for thus it may be hoped that at least some of the wounded will be saved who otherwise would have perished.

ENTWICKLUNG UND HEUTIGER STAND DES VERWUNDETEN-TRANSPORT-UND VERSORGUNGSWESENS IN DER DEUTSCHEN MARINE.

Dr. H. HOFFMANN, Marine-Generaloberarzt im Reichs-Marine-Amt.

Meine Herren, ich will versuchen, Ihnen, entsprechend der Kürze der zur Verfügung stehenden Zeit, in knappsten Umrissen einen Ueberblick über Entwicklung und heutigen Stand des Verwundeten-transports- und Versorgungswesens in der deutschen Marine zu geben.

Dass ich Ihnen damit allzuviel Neues bringen werde, wage ich nicht zu hoffen. Manche der zu erwähnenden Massnahmen sind wohl schon durch Fachzeitschriften bekannt geworden—andere lehnen sich an ähnliche Massnahmen anderer Marinen an—alle aber stützen sich auf Grundsätze, die sich in den Marinen, welche sich mit dem Problem unseres Themas beschäftigen, zum Teil bereits Bahn gebrochen haben oder nach meiner Ueberzeugung letzten Endes Geltung verschaffen müssen.

Einer rascheren Entwicklung des Verwundetenversorgungswesens in der Seeschlacht standen in Deutschland bis in dieses Jahrhundert hinein hauptsächlich zwei Momente entgegen:

1. Die Unterschätzung der Wichtigkeit eines geordneten Verwundetentransportwesens seitens des Seeoffizierkorps.

2. Der Unglaube eines grossen Teils des Sanitätsoffizierkorps an die tatsächliche Durchführbarkeit eines solchen im Ernstfalle.

Noch vor sechs Jahren musste ich als Geschwaderarzt gegen diese Ansicht einzelner Schiffsärzte ankämpfen, welche mit ihr einem laisser aller auf diesem Gebiet das Wort redeten. Verständlicher ist es, dass der Seeoffizier sich jahrzehntelang ablehnend verhielt, denn es bedarf keiner weiteren Erörterung, dass die Bekämpfung des Feindes mit dem Endziel des Sieges ohne Rücksicht auf die Versorgung der Verwundeten in erster Linie des Interesses des Seeoffiziers und der gesamten Nation steht. Fontorbe fasst diesen Gedanken in die Worte: "Quand le sort de la nation est en jeu, que pèsent quelques vies d'hommes?"

Allmählich brach sich aber immer mehr die Erkenntnis Bahn, dass eine Anzahl Verwundeter, die auf den Gefechtsstationen unversorgt liegen bleibt, nicht nur durch ihr Stöhnen und ihren Anblick einen bedenklichen Einfluss auf die Kämpfenden auszuüben imstande ist, sondern dass sie auch zweifellos ein rein mechanisches Hindernis für die Bedienung des Geschützes darstellt. Eine schnelle Räumung der Gefechtsstationen wurde somit zum militärischen Grundsatz erhoben. Damit war endlich die Bahn für eine moderne Entwicklung des Verwundetentransportwesens in der deutschen Marine frei, denn die bei dem grösseren Teil der Sanitätsoffiziere in Bezug auf diese wichtigen Fragen schon lange vorherrschenden Gedanken fanden nunmehr die Unterstützung der massgebenden militärischen Dienststellen.

Preussen (Deutschland) beschäftigt sich seit Mitte des vorigen Jahrhunderts mit der Reglementierung des Verwundetentransportwesens; 1859 erschien das "Reglement für den Sanitätsdienst an Bord der Königlich preussischen Schiffe." Neue Verordnungen folgten auf grund der gesammelten Erfahrungen in den Jahren 1864, 1877 and 1882. Im letzteren Jahre erschien bereits eine "Anleitung zum Unterricht der Krankenträger," die 1903 modernisiert worden ist und an deren Umarbeitung zur Zeit wiederum gearbeitet wird.

Das Personal für die Versorgung der Verwundeten war zunächst auf 2 Prozent der Besatzungsstärke normiert. Bedenklicher aber fast noch als diese kleine Zahl der Krankenträger war ihre Auswahl aus den sogenannten "Funktionären," also Leuten, die eigentlich eine andere Funktion hatten (Köche, Kellner) und deshalb bei den Klarschiffübungen entweder überhaupt fehlten oder oft weggeholt wurden. Die Ausbildung blieb dabei stets eine durchaus ungleichmässige und unvollkommene. Ich will den Weg, den die Ausbildung der Krankenträger mit der Zeit genommen hat, als unwesentlich überspringen und mit Schilderung des heutigen Zustandes abschliessen. Heut wird in der deutschen Marine die gesamte Mannschaft in Hand- und Hängematts-Horizontaltransport und in der ersten Hilfeleistung ausgebildet—nämlich im Anlegen der lebensrettenden Gummibinde,

sowie kleiner Verbände, welche Leichtverwundete an Ort und Stelle wieder kampffähig zu machen bestimmt sind, endlich in der Ausführung der künstlichen Atmung. Andere Wunden sollen von diesen "Laien" nicht verbunden werden, es sei denn, dass sonst während des Transportes bis zum Verbandplatz Verschmutzung der Wunde zu befürchten ist. Die sogenannten eigentlichen Krankenträger 8 bis 12 führen den Vertikaltransport durch. Sie sind ausserdem die Helfer auf den Verbandplätzen und Lagerräumen. Um diesen Aufgaben gerecht werden zu können, werden sie schon in Friedenszeiten zeitweilig zum Dienst im Schiffslazarett hinzugezogen, um ihnen dort die während der Klarschiffübungen bereits instruktionsmässig beigebrachten Kenntnisse zu vertiefen, sie praktisch an Hilfeleistungen im Krankenzimmer (Messen der Körperwärme, Zählen des Pulses und der Atmung, Halten von Körperteilen bei operativen Eingriffen u. s. w.) und überhaupt an die Eindrücke einer Krankenanstalt zu gewöhnen.

Wirkliche Fortschritte im Verwundetenversorgungswesen liessen sich aber nur erwarten, wenn auch dem Ort der ersten ärztlichen Hilfe, dem Verbandplatz, den Bremand den "pivot" der ganzen Organisation nennt, grösseres Interesse entgegengebracht wurde. Auch in diesem Punkte war eine Besserung der früher bestehenden, teilweise unglaublichen Zustände erst möglich, nachdem der Seeoffizier dem Verwundetenversorgungswesen erhöhte Beachtung geschenkt hatte. Ich habe noch 1890 auf S. M. S. *Friedrich der Grosse* mit den Krankenträgern in einer Kettenlast gesessen, in der man nicht aufrecht stehen konnte, ohne irgendwelche Ventilation, ohne Beleuchtung (eine Lauflaterne war das einzige, was uns zur Verfügung stand), ohne Wasser, ja ohne die Möglichkeit überhaupt einen Tisch aufstellen zu können. Dass unter diesen Verhältnissen von einem ärztlichen Arbeiten während des Gefechts keine Rede sein konnte, ist ohne weiteres ersichtlich. Heut haben wir nun das so lange erstrebte Ziel erreicht, dass schon beim Bau des Schiffes Ort, Grösse und Ausstattung des Verbandplatzes festgelegt und Verbandplätze eingebaut werden, die den ärztlichen Forderungen, soweit sie an Bord eines Kriegsschiffes überhaupt erfüllbar sind, Rechnung tragen.

Die Zahl der Verbandplätze war in Deutschland zunächst auf einen beschränkt, schon in der Mitte der neunziger Jahre des vorigen Jahrhunderts machte sich aber das Bestreben bemerkbar, zwei getrennt von einander liegende Stellen des Schiffs für ärztliche Hilfeleistung einzurichten und, wo die räumliche Beschränkung dies nicht zuliess, wenigstens einen Teil des ärztlichen Instrumentariums und vor allem der Verbandstoffe an einem zweiten Orte geschützt zu lagern. Auf die Gründe hierfür einzugehen, kann ich mir versagen, da sie auf der Hand liegen. Gewöhnlich wurden nun ein Hauptverbandplatz im Mittelteil des Schiffes und ein Reserveverbandplatz

im Vor- oder Achterschiff aufgeschlagen. Nachdem einzelne neuere Schiffe ein Längsschott in der Längsachse des Schiffes erhalten haben, ist es möglich geworden, die beiden Verbandplätze auch nebeneinander zu legen. Benutzt wird im Gefecht dann der jeweils in Feuerlee gelegene Verbandplatz. Diese Zusammenlegung hat den grossen Vorteil der Konzentration von Personal und Material. Von einer weiteren Erhöhung der Zahl der Verbandplätze (*Formidable* der französischen Marine hatte z. B. 6 und *Ruggiero di Lauria* 4 Verbandplätze vorgesehen) versprechen wir uns in Deutschland nichts, da naturgemäss aus militärischen Gründen umsoweniger auf die besonderen Forderungen des Verwundetenversorgungswesens Rücksicht genommen werden kann, je grösser der für diese Zwecke geforderte Raum ist.

Im Brennpunkt des Streites über die Lage des Verbandplatzes hat wohl in allen Marinen die Frage gestanden: Soll der Platz unter oder über dem Panzerdeck angelegt werden? Deutschland hat sich im Prinzip für Anlage im Panzerschutz entschieden. Wir befinden uns damit scheinbar in Widerspruch zur englischen Marine, wenigstens erklärt Holborne, dass "gute Verbandräume im Hinblick auf das Schiff als Gefechtsmaschine immer Ideale bleiben und dass im Gefecht auch gute Extraräume unleidlich werden müssen, da Hitze, Dunst und Lärm, durch die Ventilatoren dringender Staub, Enge und Versagen des elektrischen Lichts jeden Raum unbenutzbar machen werden." Diese Auffassung entspricht der in der Seeschlacht von Santiago auf spanischen Schiffen vertretenen, in der sich nach Loic Petit die Verwundeten geweigert hätten, auf die Verbandplätze unter Panzerdeck zu gehen, weil sie es vorgezogen hätten, lieber zu fallen, als "d'être enterrés vivants." Wir Deutschen stehen auf dem Standpunkt, dass der Versuch einer Versorgung der Verwundeten im Panzerschutz überall da, wo es möglich ist, wenigstens gemacht werden muss. Treten auf diesen geschützten Verbandplätzen Verhältnisse ein, wie die von Holborne geschilderten, so bleibt natürlich nichts übrig, als den Platz zu verlassen und ihn nach einer anderen Stelle zu verlegen, unter Umständen selbst an ungeschützte Stellen. Letzteres bleibt ja den kleineren Schiffen aller Flotten sowieso nicht erspart. Auf diesen Schiffen versuchen wir, den Verbandplatz durch provisorische Massnahmen, Hängematten, Ankerketten, u. s. w., wenigstens gegen Splitterwirkungen zu schützen.

Zu den Bedingungen, die wir an einen Verbandplatz im Panzerschutz stellen, gehören gute Ventilationseinrichtungen, genügende Beleuchtung und reichliche Versorgung mit Wasser und Eis.

Auf die durch die Ventilation den Gefechtsverbandplätzen drohenden Gefahren will ich hier nicht näher eingehen, da das Thema der Rauch Vergiftungen an Bord auf dem Kongress besonders

vertreten werden wird. Es genügt hier deshalb die Bemerkung, dass das Sanitätspersonal unserer Schiffe einschliesslich der auf den Verbandplätzen verwendeten Krankenträger über die maschinellen Einrichtungen der Luft Zu- und Abfuhr auf diesen Plätzen genau unterwiesen wird, so dass es in der Lage ist, die Maschinen nach Bedarf bzw. Zwangslage in oder ausser Betrieb zu stellen.

Gegen die Gefahr des Erlöschens der elektrischen Beleuchtung auf den Verbandplätzen bei Zerstörung der allgemeinen Leitung rüsten wir die Plätze mit tragbaren Akkumulatorenbatterien aus, welche genügendes Licht zum Weiterarbeiten spenden.

Für reichliche Warm- und Kaltwasserzuleitung ist gesorgt—in gleicher Weise Anschluss des Sterilisierapparates an die elektrische und an die Dampfleitung.

Dem Bedürfnis nach Eis ist durch festen Einbau grosser Eiskisten auf dem Gefechtsverbandplatz Rechnung getragen.

Leider kann ich von gleichen Fortschritten im Ausbau der Transportwege und der Transportstationen nicht berichten, da wir eine Verbreiterung der Durchgänge der wasserdichten Schotten, eine Vergrösserung der Panzerluken oder auch nur ein Uebereinanderliegen der Luken in den verschiedenen Decks wenigstens an ein oder an zwei Stellen des Schiffs, die dann als Transportstationen auszuwählen wären, bisher nicht erreicht haben und voraussichtlich aus schiffsbautechnischen Rücksichten auch nicht erreichen werden.

Ueber die Ausstattung der Verbandplätze kann ich rasch hinweggehen. Neben der medizinisch-chirurgischen Ausrüstung, die derjenigen in Friedenszeiten entspricht, achten wir darauf, dass Sauerstoffbomben, sowie grosse Mengen sofort verwendbarer Morphiuminjektionslösungen und zahlreiche Gefässe mit Kochsalzinfusionsflüssigkeit klar stehen, denn wir glauben, dass neben der lebensrettenden Kochsalzinfusion die Verabfolgung starker Morphiuminjektionen auf Verbandplätzen und Lagerräumen ein häufiger Gegenstand der ersten Hilfeleistung sein wird. Dagegen halten wir in der Mehrzahl die Auslieferung der Morphiumlösung in die Hände von "Laien" (Seeoffizieren und Unteroffizieren) in gleicher Weise für unstatthaft, wie die Verteilung des Schleichschen Narkosegemisches an Schwerverletzte zur Selbstbetäubung.

Eng verbunden mit der Sorge um geschützte und geräumige Verbandplätze ist die Sorge um ausreichende Lagerungsräume auf denen die "abgefertigten" Verwundeten gelagert und weiter versorgt werden. Auf unseren neueren grossen Schiffen bieten die an die Verbandplätze angrenzenden Räume genügend Platz für diese Zwecke. Sie werden bereits vor Beginn des Gefechts mit Hängematten und frischer Wäsche ausgestattet, auch werden Labemittel in reichlicher Menge bereit gehalten.

Zu erwähnen bleibt schliesslich an dieser Stelle noch die Ausstattung der Gefechtsstationen mit Verbandtaschen, welche sterile " Einzelverbände " für kleinere Verletzungen, Schienen und Polsterwatte für Stützverbände bei Knochenbrüchen und Gummibinden zur Stillung gefährlicher Blutungen enthalten. Daneben sind an den Geschützen Behälter für feuchte Borsäuretupfer, welche der Geschützbedienung das Auswaschen der Augen gestatten.

Die vorerwähnten Einzelverbände sind übrigens auch auf den Verbanplätzen—und zwar in 3 Grössen—vorhanden. Wir erhoffen von ihnen nicht nur die sachgemässere und Infektion leichter vermeidende Verbandanlegung seitens der Mannschaften und Krankenträger, sondern auch eine Erleichterung der Tätigkeit der Aertze selbst.

Ich komme nun zu der schwierigen Frage nach dem zweckmässigsten Tranportmittel. Die Mannigfaltigkeit der bei allen in Betracht kommenden Flotten für diesen Zweck erfundenen Typen weist klar auf die beklagenswerte Unsicherheit hin, die auf diesem Gebiete geherrscht hat. Auffret vergleicht diese Tatsache mit einem Baum, der tausend Blätter, aber keine Früchte trägt. Er prägt das geistreiche Paradoxon " cette richesse c'est la pire des pauvretés."

In Deutschland war an Bord unserer Schiffe neben der hauptsächlich für Landungszwecke bestimmten Krankentrage, die, soviel ich ersehen kann, in der japanischen Marine auch heute noch an Bord verwendet wird, der Krankentransportstuhl eingeführt, der mancherlei Vorteile bot, bei der winkligen Bauart der moderneren Schiffe aber immer mehr in den Hintergrund geschoben wurde. Er ist in diesem Jahre nach rund 50jähriger Vorherrschaft im deutschen Verwundetentransportwesen ganz aus der Liste der Bordtransportmittel gestrichen worden. Seit Anfang der neunziger Jahre des vorigen Jahrhunderts strebte man in Deutschland danach, ein möglichst schmales Transportmittel zu erfinden, das den baulichen Verhältnissen angepasst war und doch auch dem Verwundeten gerecht wurde. Ueber einfache Bretter, welche mit Befestigungsgurten versehen waren, und die gewöhnliche Mannschaftshängematte führte der Weg allmählich zur Transporthängematte, welche, 1899 eingeführt, zur Zeit bei uns das herrschende Transportmittel geworden ist. Sie ist eine modifizierte Mannschaftshängematte mit den für die Sicherheit und Bequemlichkeit des Verwundeten nötigen Abänderungen. Eine Kopfhaube stützt den Kopf; ein Brustgurt ist geeignet, beim Vertikaltransport das Hauptgewicht des Mannes bei Verletzungen der Wirbelsäule und des Beckens zu tragen, während ein Schenkelriemen, auf dem der Verwundete gewissermassen reitet, die Last des Körpers in den übrigen Fällen, insbesondere bei allen Knochenbrüchen der unteren Gliedmassen aufnehmen soll. Zum Schutz der Füsse ist ein Fusssack angebracht. Das Schliessen der Hängematte geschieht durch Bänzel.

Der wichtigste Teil unserer Hängematte ist aber eine durch zwei Eschenlatten erreichte Versteifung, welche ohne wesentliche Erhöhung des Gewichts das Durchbiegen des Transportmittels verhindert. Wir haben uns damit in dem besonders in Frankreich entbrannten Streit um "mobilité et flexibilité" (Guézennecauf der einen und "rigidité" (Auffret) auf der anderen Seite auf die Seite der letzteren gestellt, wie dies in gleicher Weise Japan mit seiner durch jalousieartig angeordnete Bambusstäbchen versteiften Hängematte nach Totsuka und andere neue Erfindungen tut.

Ich streife noch mit einem Wort die zahlreichen Erfindungen der deutschen Schiffsärzte aus den letzten Jahren des Hastens und Tastens nach einem Idealtransportmittel. Nach den Erfahrungen der letzten Seekriege, in denen der Einzeltransport, das heisst, der Transport eines Verwundeten durch einen Träger eine so bedeutende Rolle gespielt hatte, sollte ein diesen Zwekken entsprechendes Transportmittel erfunden werden. Der in unserer Marine gebräuchliche Kohlensack und einfache Tauringe, mittels deren der Verwundete auf dem Rücken seines Trägers festgehalten wurde, Kraxen, den Gepäcktransportmitteln in Gebirgsgegenden nachgeahmt, und andere—ich streife diese Erfindungen nur, um zu zeigen, dass die Mannigfaltigkeit der erfundenen Transportmitteltypen bei uns nicht geringer gewesen ist, als in anderen Marinen—sie alle sind zur Zeit bei uns ad akta gelegt und weitere Erprobungen neuer Erfindungen ausdrücklich verboten—mit einziger Ausnahme der Erprobung des Transports von Deck zu Deck auf der schiefen Ebene, der Gleitschiene. Die oesterreichisch-ungarische Marine hauptsächlich ist uns auf diesem Gebiet vorangegangen—es ist mir unbekannt geblieben, ob die Versuche dort zu einem positiven Ergebnis geführt haben oder aufgegeben sind. Unsere Gleitbahn besteht aus einem einfachen Gestell aus Gasrohren, bespannt mit Segelleinen, das oben und unten winklich umgebogen ist. Die obere spitzwinklige Umbiegung dient zum Überhaken über das Süll des oberen Luks, die untere stumpfwinklige stellt den Fuss der Bahn auf dem unteren Deck vor. Die Gleitschiene ist in Sekundenfrist am Luk angestellt und ebenso rasch wieder beseitigt. Es ist klar, dass ein Massentransport von Deck zu Deck mittels dieser Vorrichtung bei ausreichendem Transportpersonal in beiden Decks ausserordentlich viel rascher vor sich gehen wird, wie ein solcher mittels Stuhl, Hängematte oder jedem anderen Transportmittel, welches erst über dem oberen Luk durch Talje befestigt, dann mittels Fierens herabgelassen und nach Entfestigung im unteren Deck zur Aufnahme eines Neuverwundeten aufgeheisst werden muss.

Meine Herren, wir haben also in der deutschen Marine dem Erfindergeist zur Zeit Halt geboten, wir arbeiten augenblicklich nur mit Handtransport, der für gewöhnlich gewählt werden soll, der Transporthängematte, die bei Brüchen der Wirbelsäule und der unteren

Gliedmassen und bei Verletzungen der Körperhöhlen zur Verwendung kommen soll, und der Gleitschiene. Erst wenn einmal jahrelang mit diesen drei Transportmitteln auf allen Schiffen der Flotte wird gleichmässig gearbeitet worden sein und die sich auf sie aufbauenden Grundsätze des Transportwesens Sanitäts- und Seeoffizieren, ja der ganzen Besatzung gewissermassen in Fleisch und Blut werden übergegangen sein; erst dann werden wir die Zeit für uns gekommen erachten, nach neuen Verbesserungen zu suchen.

Ich will das Gebiet der Transportmittel nicht verlassen, ohne derjenigen Vorkehrung zu gedenken, die auch nach unserer Ueberzeugung ein ideales Transportmittel darstellen würde: den in Panzerschutz verlaufenden, elektrisch betriebenen Lift. Der für den Verwundeten so peinliche Transport in vertikaler Körperstellung verschwände hiermit fast ganz, er wäre nur noch für den Transport aus den Marsen und den untersten Schiffsräumen nötig. Soweit hier bekannt, hat Japan diesen Gedanken schon verwirklicht, so dass es von Interesse wäre, von einem Vertreter der japanischen Marine vielleicht über diesen Punkt etwas zu hören. Ich fürchte, dass die Aussichten auf Verwirklichung dieses Ideales in der deutschen Marine sehr gering sind, weil, wie ich bereits an anderer Stelle zum Ausdruck gebracht habe, der Schiffbau aus militärischen Gründen uns nicht jeden Wunsch, den wir haben, erfüllen kann. Immerhin eröffnet sich hier eine Perspektive, die im Auge zu behalten sich eines Tages vielleicht doch verlohnt haben wird.

Ich habe bisher diejenigen Massnahmen aufgezählt, welche Sache langer Friedensvorbereitungen sind: Die Vorbereitungen im Bau des Schiffes und in der Materialausstattung der Gefechtsstationen und Verbandplätze, der Vollständigkeit der Skizze wegen habe ich nun noch kurz diejenigen Vorbereitungen zu erwähnen, die, möglichst unmittelbar vor dem Kampf einsetzend auf eine Verhütung der Infektion der Wunden und eine Verminderung ihrer Schwere und Ausdehnung hinzielen.

Die Hygiene schreibt uns in allgemeinen vor, unsere Kleidung und unsere Umgebung sauber zu halten. Wir wissen zwar, dass aus hier nicht weiter zu erörternden Gründen die Luft, die Wände, der Fussboden u. s. w. unseres Wohnraumes, des Schiffes verhältnismässig keimarm sind; wir beugen schon in Friedenszeiten jeder Schmutzansammlung selbst in den dunkelsten Ecken vor; wir achten auch in Friedenzeiten schon auf grösstmöglichste Sauberkeit der Kleidung unserer Mannschaft, unserer Hängematten und Wollderken, im Kriegsfalle aber müssen wir diese unsere Bemühungen verdoppeln. Das Ideal wäre hiernach, dass jeder Mann frisch gebadet und mit frischer Wäsche und Kleidung versehen in die Schlacht zöge. Gaskell macht deshalb den Vorschlag, für jeden Mann einen sterilen Anzug nebst Unterzeug für die Schlacht bereit zu halten. Er ver-

gisst aber, dass die Sterilität mit der Zeit verloren geht, dass die Kleider in diesem Zustande allmälich brüchig und unbrauchbar werden und dass vor allem mit einem hohen Grade von Wahrscheinlichkeit uns gar keine Teit zur Anlegung dieser Kleider vor der Schlacht verbleiben wird. Wir haben uns deshalb diesen Vorschlag nicht zu eigen gemacht. Andere Vorschläge gingen dahin, mit entblösstem Oberkörper kämpfen zu lassen. Meine Herren, sie wissen, dass wir mit Annahme dieses Vorschlages aus der Scylla in die Charybdis kommen. Für die Gefahren einer Verunreinigung der Wunden durch Infektionskeime, die den Kleidern anhaften können, tauschen wir die Gefahren vermehrter und schwererer Brandwunden ein. Zur Verminderung dieser Gefahren schlägt Gaskell vor, auch das Gesicht durch Anlegen von Gesichtsmasken zu schützen. Militärische Gesichtspunkte haben uns auch von der Annahme dieses Vorschlags abgehalten.

Zur Vermeidung überflüssiger Splitterwirkung hat jeder Kampfteilnehmer aus seinen Taschen alles absolut überflüssige zu entfernen.

Endlich muss noch die Frage der Ernährung vor und in der Schlacht berührt werden. Die Gefahren der zu erwartenden Unterleibsverletzungen werden bekanntlich durch Leere der Verdauungsorgane sehr erheblich herabgeretzt. Die hiersus für unter Thema zu folgernden Forderungen ergeben sich von selbst. Wir ersehen aber auch an dieser Stelle wieder, wie schwer sich im Ernstfalle Theorie und Praxis werden vereinigen lassen, denn wir werden zumeist den Beginn der Schlacht nicht auf Stunden genau im voraus wissen, um ohne weiteres dieser Forderung gerecht werden zu können; dazu können wir die Mannschaft aus militärischen Gründen ebenso wenig mit dem Gefühl des Hungers in die Schlacht ziehen lassen, wie wir ihnen aus ebendiesen Gründen auch während der Schlacht nicht jede Stärkung vorenthalten können.

Wenn Sie mich nun fragen, ob wir deutschen Sanitätsoffiziere überzeugt sind, mit der vorskizzierten Reglementierung des Verwundetentransportwesens allen Eventualitäten der Seeschlacht gewachsen zu sein, so lautet die Antwort kurz und bündig: "Nein." Die Ueberraschungen, die der Ernstfall über ein Schlachtschiff ausschütten kann, sind so mannigfaltig und so furchtbar, dass sie jedes, auch das bestvorbereitete System über den Haufen werfen können. Wir werden deshalb auch in Zukunft ohne Modifikation unserer Friedensorganisation im Ernstfalle nicht auskommen, denken wir zum Beispiel an die Zerstörung eines der Luks, durch das nach dem Schema der Vertikaltransport geleitet werden soll (die sogenannte Transportstation) oder gar an diejenige des einen oder anderen Verbandplatzes, die doch auch bei panzergeschützter Lage nicht ausgeschlossen ist. Solche Ereignisse machen Abänderungen des Friedensschemas unbedingt nötig. Diese werden aber umso schnel-

ler und umso zweckentsprechender getroffen und durchgeführt werden, je besser das Schema selbst in Friedenszeiten einexerziert war. Hierin liegt der fundamentale Unterschied zwischen unserem heutigen und dem in meinen einleitenden Worten erwähnten früheren Standpunkt des laisser aller eines Teiles unseres Korps.

Zum Schlusse lenke ich ihre Aufmerksamkeit noch mit einigen Worten auf die Grenzen, die nach unserer Ansicht der ärztlich-chirurgischen Tätigkeit während und unmittelbar nach der Seeschlacht gezogen sind. Nicht nur die beschränkten räumlichen Verhältnisse unserer Schiffe, sondern noch vielmehr die beschränkte Zahl der zur Verfügung stehenden Aerzte (auf unseren grössten Schiffen sind es drei) legen eine weise Selbstbeschränkung in dieser Beziehung nahe. Oberster Grundsatz muss bleiben: Ueber der Fürsorge für den Einzelnen das Ganze nicht aus den Augen zu verlieren.

Wir rechnen mit etwa 20 Prozent Verlusten—5 Prozent Tote, 10 Prozent Schwer- und 5 Prozent Leichtverletzte. Das ergibt für die drei Aerzte eines Linienschiffs mit 1,000 Mann Besatzung die Aufgabe der ärztlichen Versorgung von 100 Schwer- und 50 Leichtverletzten. Um diesen Aufgaben gerecht werden zu können, ist eine schon in Friedenzeiten wohl durchdachte Organisation des Verbandplatzes von nöten. Bergmann hat diese Forderung in die Worte gekleidet: "Die Organisation des Verbandplatzes, die Disposition der Aerzte auf ihm und die Sortierung der sich herzudrängenden Verwundeten sind die unerlässlichen Vorbedingungen für die rettende und heilsame Arbeit auf dem Sammelplatz der Opfer des Schlachtfeldes."

Die im Jahre 1907 erschiene Kriegssanitätsordnung der deutschen Armee trägt diesem Grundsatz Rechnung, indem sie den Hauptverbandplatz in eine Empfangs- und eine Verbandsabteilung einteilt und auf ersterer die erste Sonderung der ankommenden Verwundeten zur Entlastung der Verbandsabteilung vornehmen lässt.

Auch die Marine muss unbedingt danach streben, diesen Gesichtspunkten Geltung zu verschaffen, wenn sie sich nicht dem Vorwurf aussetzen will, in ihren Vorbereitungen eine Lücke bestehen zu lassen. Hiernach muss auch auf unseren grösseren Kampfschiffen, welche wenigstens über zwei Aerzte verfügen, der Strom der Verwundeten über eine Empfangsstation (Hilfsverbandplatz) geleitet werden, auf welcher ein Arzt mit Unterstützung eines Sanitätsunteroffiziers und von zwei bis vier Krankenträgern die erste Sortierung der Verwundeten vornimmt. Verwundete, deren Zustand gänzlich aussichtslos ist, sind vom Hauptgefechtsverbandplatz fern zu halten und ohne weiteres den für sie bestimmten Lagerräumen zuzuweisen; desgleichen haben Verwundete, die auf dem Hilfsverbandplatz (Empfangsabteilung) abgefertigt werden können, oder die ihn viel-

leicht sogar schon mit gutsitzenden Notverbänden betreten, auf dem Hauptgefechtsverbandplatz nichts zu suchen. Die Zahl der Verwundeten, die den Hauptgefechtsverbandplatz (die Verbandabteilung) erreichen soll, ist hiernach eingeschränkt. Auf ihm wirkt das gesamte übrige Sanitätspersonal—1 bis 2 Aerzte, 3 bis 4 Sanitätsunteroffiziere und 6 bis 8 Krankenträger. Hier ist die Stätte, auf der alle schwerer Verletzten diejenige Hilfe erhalten, deren sie für den Weitertransport, die Ueberführung auf Hospitalschiffe und in Landlazarette, also bis zur endgültigen Versorgung bedürfen. Auch auf dem Hauptgefechtsverbandplatz sollen nur solche grösseren Eingriffe vorgenommen werden, die unaufschiebbar sind: Blutstillungen, Notamputationen und Luftröhrenschnitte. Alle weiteren Massnahmen sind, sofern eine Ueberführung auf ein Hospitalschiff oder in ein Landlazarett in kurzer Zeit erfolgen kann, im allgemeinen diesen Krankenanstalten vorzubehalten.

Je schneller nun die Ueberführung in dieselben erfolgt, um so günstiger werden sich letzten Endes die Ziffern des Gesamtverlustes gestalten, denn hier erst kann der Verwundete der Segnungen der Chirurgie und einer geordneten Krankenhausbehandlung voll teilhaftig werden. Die Tatsache, dass im letzten russisch-japanischen Kriege 80 Prozent der verwundeten japanischen Seeleute ihren Dienst an Bord noch während des Krieges wieder aufnehmen konnten, weist ebenfalls wieder auf die enorme militärische Bedeutung hin, die einem wohldurchgebildeten Verwundetenversorgungswesen zugebilligt werden muss. Es ist nicht meine Aufgabe, heut auf das Thema der Ausschiffung der Verwundeten einer Flotte einzugehen. Ich darf aber meine kurze Skizze mit der Bitte an die Flotten der Vereinigten Staaten, Englands und Japans schliessen, uns gelegentlich auch die Erfahrungen zu übermitteln, die sie schon in Friedenszeiten mit ihren Lazarettschiffen und der Ausschiffung Verwundeter und Kranker auf dieselben gemacht haben.

STATIONS DE PANSEMENTS ET TRANSPORT DES BLESSÉS DANS LES COMBATS SUR MER.

Dr. Prosper Barthélémy, Médecin en Chef de la Marine, Délégué Officiel du Département de la Marine Française.

Postes de pansements, postes de secours, hôpitaux de combat, dressing stations, sont autant de termes qui indiquent en quel endroit du navire les blessés des guerres maritimes doivent recevoir les premiers secours. La question n'est pas nouvelle; depuis longtemps déjà tous les congrès qui comportent une section de médecine navale l'inscrivent dans leur programme.

Cette sollicitude prouve que chez tous les peuples les mêmes sentiments de généreuse humanité réclament des soins rapides et pratiques pour les marins tombés au service de la Patrie.

C'est aussi la démonstration que la formule idéale n'est pas encore trouvée.

Malgré de nombreuses discussions, en dépit de remarquables travaux écrits par des médecins de la Marine et même des amiraux qui n'ont pas dédaigné de prendre la plume pour exposer leurs idées, cette importante question qui doit à juste titre préoccuper le commandement autant que nous-mêmes, n'est pas encore complètement résolue.

C'est pour cette raison, que courageusement nous reprenons le sujet avec la ferme conviction non pas de le clore, mais d'apporter une pierre nouvelle à l'édifice, aidé en cela par les écrits du passé, par l'enseignement des dernières guerres maritimes, par notre propre expérience.

Avant d'entamer la discussion, je tiens ici, au milieu de ce brillant congrès, où toutes les Marines du monde civilisé sont représentées, à rendre un public hommage à l'un de nos aînés, à un chef vénéré, brutalement ravi l'année dernière à l'amour des siens, à ma grande affection. J'ai nommé le Dr. Auffret ancien Inspecteur-Général du Corps de Santé de la Marine Française; l'étude des secours aux blessés dans les guerres maritimes a été l'objet de ses constantes préoccupations; ses longues méditations l'ont amené à faire d'heureuses inventions, à écrire de remarquables ouvrages.

Inventeur, il nous a donné sa gouttière pour le transport des blessés, le matériel métallique pour les hôpitaux de bord.

Ecrivain, nous lui devons de nombreux écrits, dont le plus important sur les secours aux blessés fut couronné par le prix Romberg.

Ce pieux devoir accompli, je reprends l'étude de la question.

Le Dr. John Cropper Wyse, Médecin Général de la Marine des Etats-Unis, a publié en mars 1905 un remarquable travail sur les premiers secours aux blessés dans un combat naval.

Les questions suivantes y sont particulièrement étudiées:

1°. Emplacement des postes des blessés.

2°. Poste et devoirs des médecins pendant le combat.

3°. Pansements d'urgence.

Ses conclusions sont:

1°. Que les médecins ne doivent pas insister pour avoir des postes des blessés installés définitivement sur les navires pendant leur construction alors que, à la mer ou pendant le combat, ces postes ne pourraient peut-être pas fonctionner par suite d'empêchements imprévus et insurmontables.

2°. Que dans un combat naval prolongé les blessés seront en si grand nombre qu'ils ne pourront pas recevoir les secours du médecin et qu'ils doivent être capables de se secourir eux-mêmes.

3°. Ces médecins comme les autres officiers ne doivent pas s'exposer inutilement, mais il n'est pas possible d'admettre que leur réclusion ou leur inactivité pendant le combat soient réclamées par les conditions de la guerre moderne ni justifiées par des considérations d'humanité.

Au cours de son étude, le distingué Dr. J. C. Wyse critique assez vivement les opinions des médecins espagnols et français, Redondo et Richer de Forges qui posent en principe que pendant la période aiguë du combat, le personnel médical doit être tenu à l'abri sous cuirasse prêt à répondre au premier signal qui lui sera fait par le commandant pour intervenir utilement.

" Nous avons le certitude," die J. C. Wyse, " qu'aucun médecin de la Marine américaine ne sera ni entraîné, ni influencé par une telle opinion. Nous croyons plutôt que tout combat maritime est un risque dont nous devons prendre notre part."

C'est là un beau geste qu'applaudiront tous les médecins de la Marine, sans distinction de nationalité, parce que tous sont également braves et possèdent au plus haut degré ce bel esprit de sacrifice qui a eu si souvent l'occasion de se manifester.

Mais il ne peut être question ici de courage personnel; deux opinions sont simplement en présence; le problème posé est celui-ci: les médecins, au plus fort du combat, doivent-ils rester à l'abri sous cuirasse? Doivent-ils au contraire se multiplier, courir partout où il y a des blessés, entraînant avec eux leurs brancardiers et leurs infirmiers?

Je crois la question définitivement jugée depuis la dernière guerre maritime entre la Russie et le Japon.

Au plus fort de la lutte, alors que les projectiles tomberont comme grêle sur toutes les parties du navire, les médecins ne pourront intervenir. Ils seraient fétus de paille bientôt balayés par l'ouragan. Leur rôle se bornera à attendre dans l'entrepont cellulaire, une embellie, une trève ou un ralentissement dans la lutte pour s'élancer aussitôt au secours des blessés, et cela, sur ordre du commandant, ordre provoqué s'il le faut, mais dont ce dernier doit rester seul juge pendant toute la durée du combat, le service de santé devant être pour lui un auxiliaire précieux et non une gêne, même momentanée.

Je dois ajouter que Monsieur le Médecin Général John C. Wyse, un an plus tard s'est exprimé dans les termes suivants au Congrès de Lisbonne.

" In regard to the stations of the medical officers, where there is but one, in my opinion, his safety should be carefully conserved, but

when there are more the medical officers should move freely about the ship to any point where emergent surgery may be demanded."

Nous ne sommes pas loin d'être du même avis et de nous entendre.

Ce point étant acquis, divisons notre travail, établissons un sommaire du sujet qui a été mis à l'ordre du jour par les distingués organisateurs du Quinzième Congrès d'Hygiène et de Démographie auquel nous avons le grand honneur d'assister.

Les quatre chapitres suivants seront successivement étudiés :

1°. Doit-il y avoir un ou plusieurs postes de pansements; quels emplacements doivent-ils occuper?

2°. Les postes de pansements doivent-ils être prévus dès la construction du navire ou seulement avant le combat?

3°. De quel objet de pansements doivent être pourvus les postes de pansements?

4°. Fonctionnement de ces postes. Utilité d'enseigner aux marins la manière de se servir des pansements tout préparés.

I. DOIT-IL Y AVOIR UN OU PLUSIEURS POSTES DE PANSEMENTS : QUELS EMPLACEMENTS DOIVENT-ILS OCCUPER?

Les flottes de combat des grandes puissances maritimes ne sont plus composées aujourd'hui que de cuirassés, de croiseurs-cuirassés et de puissants destroyers. Les deux premiers types seuls entreront en ligne dans une bataille rangée. Ce sont des navires bien protégés dans leurs œuvres vives, munis de tourelles, de casemates, de blockhaus.

Comment ces machines de guerre se présenteront-elles au combat?

Le cuirassé entrant en lutte est un navire dont les œuvres mortes sont inhabitées; tous les combattants sont à l'abri derrière d'épaisses murailles d'acier. Le commandant et ses auxiliaires sont enfermés dans le blockhaus, cerveau du navire, citadelle élevée, dominant le pont, découvrant au loin l'horizon.

Les canonniers se tiennent à leurs pièces, c'est-à-dire, dans les tourelles, dans les casemates d'où émerge seulement la volée des canons qui doivent porter la destruction et le feu sur les navires ennemis.

Les mécaniciens, les chauffeurs habitent les machines, les chaufferies, vision de l'enfer du Dante lorsque le navire marche à toute puissance; tous ces organes sont protégés par les ponts cuirassés. Enfin, dans l'entrepont cellulaire les fusiliers, les gabiers, attendent que le commandant les appelle sur le pont.

Ainsi donc sur un cuirassé prêt au combat, nous trouvons les combattants enfermés dans de véritables tours, formant comme autant de cellules, séparées les unes des autres par des espaces vides, reliées entre elles par des appareils de transmission.

A ces combattants disséminés dans toutes les parties protégées du navire, il faut assurer des soins médicaux, le projectile pouvant trouver le défaut de la cuirasse et envahir, au moins par ses éclats, un compartiment momentanément surpeuplé de défenseurs. Comment assurer ces secours? Evidemment par l'installation de postes de pansements. Disons tout de suite, et cela ne se discute plus aujourd'hui, "Il doit y avoir plusieurs 'dressing stations.'" Mais tous n'aurons pas la même importance. Nous aurons comme dans l'armée, le service de l'avant qui sera rudimentaire, simple secours d'urgence.

Au contraire, le service de santé de l'arrière plus important, plus complet, possédera des installations qui ne pourraient pas être réalisées sur la ligne de feu.

A ces hommes que les progrès de l'architecture navale, les nécessités de la guerre, obligent à combattre dans des compartiments bien protégés, nous ne pouvons pas songer un seul instant à offrir comme postes de secours, des locaux qui seraient moins à l'abri des coups de l'ennemi que leurs postes de combat. Il ne nous appartient pas, une fois blessés, de les déposer même momentanément dans les œuvres mortes du navire, qui, dès les premiers obus, peuvent être labourées sinon détruites. Où donc établir nos postes de pansements?

Il existe aujourd'hui sur tous les grands navires cuirassés, les seuls que nous ayions à considérer, un étage, qu'on appelle entrepont cellulaire, compris entre les deux ponts cuirassés et protégé sur les côtés par la cuirasse elle-même. Cet étage dont le tiers supérieur est au-dessus de la ligne de flottaison, se trouve à peu près à égale distance du pont et des fonds du navire.

C'est dans cette longue cellule, elle-même plusieurs fois divisée, que sur les navires de guerre français, et dans bon nombre de marines étrangères, est installé l'hôpital de combat, que nous pouvons aussi appeler service de santé de l'arrière ou poste principal de pansements.

Beaucoup de nos navires possèdent même deux postes de l'espèce; l'un à l'arrière, le plus important, celui où doit se tenir le chef du service de santé pendant le combat; l'autre à l'avant, en général plus petit, qui est le poste de combat du médecin en sous ordre.

Nous voilà loin des anciens postes de pansements repoussés dans les fonds du navire où les blessés espagnols refusaient de se laisser descendre.

Le service de santé est remonté de la cale vers le milieu du cuirassé, il n'est plus bien loin de la ligne de feu, son matériel est à l'abri, les blessés qu'on descendra des étages supérieurs pendant une accalmie ou au cours de la lutte trouveront bonne protection contre de nouveaux coups.

L'hôpital de combat du cuirassé russe *Cesarewitch* construit aux forges et chantiers de La Seyne, a été décrit par Fontan en 1904 comme le modèle du genre. Il est situé à l'arrière du navire dans

entrepont cellulaire. Cet étage est en général facilement accessible; de nombreuses échelles, des panneaux le font communiquer avec les parties supérieures et les fonds du navire.

Voilà pour le service de santé de l'arrière. Voyons maintenant les postes de secours de première ligne. De nombreux écrivains maritimes ont vanté certains locaux du bâtiment situés dans l'entrepont principal (étage immédiatement au-dessus de l'entrepont cellulaire), protégés soit par le relèvement de la cuirasse, soit par deux casemates ou deux tourelles opposées, mais nullement défendus contre les coups obliques ou contre le tir plongeant. Ces postes semblent avoir fait faillite après les enseignements des dernières guerres maritimes. (Combat du Yalou, etc.)

Aucune partie du navire, au-dessus de l'entrepont cellulaire, qui n'est pas un blockhaus, une tourelle, une casemate, n'est à l'abri des coups de l'ennemi. A tout instant, elle peut être balayée sinon détruite par les projectiles. Pourquoi vouloir dès lors en faire des postes de secours ou blessés et médecins ne tarderaient pas à être dispersés par la mitraille! Pourquoi s'obstiner à y mettre des blessés qui y seront moins à l'abri que dans leurs postes de combat!

C'est plus avant encore qu'il faut porter les postes de premiers pansements; c'est dans les fortins même où se trouvent les combattants qu'ils doivent être installés. Par conséquent, les tourelles, les casemates, les blockhaus deviendront autant de petits postes de secours; ils seront approvisionnés en eau distillée pour étancher la soif des blessés, en pansements tout préparés de différentes grandeurs pour mettre rapidement une blessure à l'abri de l'infection en attendant qu'une accalmie dans la lutte permette aux blessés de descendre aux hôpitaux de combat.

Avec cette conception d'un petit poste de secours établi dans le local même des combattants, il est nécessaire, indispensable, que chaque homme sache appliquer sommairement un premier pansement, soit capable d'être son propre " dresser " ou celui de son voisin.

Cette manière de voir a été adoptée dans la Marine française. Les hommes des tourelles, casemates, blockhaus, reçoivent une instruction de brancardier visant surtout les premiers pansements. La dépêche ministérielle du 9 octobre 1907 a rendu règlementaire à bord des navires de combat, l'installation de boîtes à pansements tout préparés dans les tourelles, casemates, blockhaus. Ces locaux devenaient donc les postes de pansements de première ligne.

II. LES POSTES DE PANSEMENTS DOIVENT-ILS ÊTRE PRÉVUS DÈS LA CONSTRUCTION DU NAVIRE OU SEULEMENT AU MOMENT DU COMBAT?

Les divergences d'opinions qui se sont jadis manifestées à ce sujet, deviennent aujourd'hui de plus en plus rares et on peut dire que l'accord est presque complètement réalisé entre médecins des différentes marines.

Le Médecin Général John C. Wyse de la brillante Marine américaine, dans son très intéressant travail cité plus haut et publié en 1905, parlant du poste des blessés, formule les conclusions suivantes: "Nous ne pouvons pas croire qu'il soit raisonnable d'insister pour avoir des postes des blessés installés définitivement sur les navires pendant leur construction, alors qu'à la mer ou pendant le combat ces postes ne pourraient peut-être pas fonctionner par suite d'empêchements imprévus."

Un an plus tard, au Congrès International de Lisbonne ce distingué médecin général était moins affirmatif: "In my opinion," dit-il, "it will be impossible to definitely fix station for the wounded in ships of war, while the question of naval construction is such a vexed question—given fixed conditions this matter might be solved, but it will be impossible to do so now."

Tous les auteurs français ou à peu près sont partisans de l'hôpital de combat prévu dès la construction sur les plans du navire.

Léo, dans un remarquable article publié en mars 1901, en arrive à cette conclusion que le poste des blessés doit être prévue dès la construction et adopte les prescriptions du Conseil Supérieur des Travaux édictant que l'hôpital de combat devra être placé à l'abri des projectiles, suffisamment ventilé, bien éclairé et le plus près possible des panneaux amenant les blessés.

"Les médecins de la Marine s'entendront," écrivait jadis le Dr. Auffret, "le jour où marins et constructeurs s'entendront eux-mêmes. Faites des types de combat plus uniformes, et quand une décision a été prise en faveur des blessés, ne touchez plus aux locaux désignés. Pourquoi," ajoutait-il, "ne prévoirait-on pas dans le plan du navire un lieu spécialement affecté à cet usage."

Couteaud et Girard partagent également cette manière de voir. Parlant des erreurs à éviter pour l'installation de l'hôpital de combat, ils écrivent: "Quand la construction d'un bâtiment est achevée il est difficile de désaffecter un local pour le convertir en poste de blessés."

Dans tous nos écrits, dans nos rapports sur cette importante question, nous avons toujours défendu cette thèse, à savoir que l'hôpital de combat devait être prévu dès la construction. Nous insistions pour qu'il soit remonté des fonds ou les blessés ne veulent pas descendre, pour être placé plus à proximité des combattants, dans un local bien protégé, facilement accessible; en un mot dans l'entrepont cellulaire.

En Angleterre le Dr. Mark Beadwell demandes pour l'hôpital de combat un local protégé spécialement aménagé. Ses idées sont complètement partagées par l'Amiral Sir Bodwen Smith qui croit à la nécessité d'avoir un local sérieusement protégé.

Chez les Italiens, le distingué Médecin de Marine Philippo Rho, dans un article très documenté formule nettement les conclusions suivantes:

"Les postes des blessés et les passages devront être étudiés pour chaque type de navire et on choisira de préférence de locaux bien aérés et bien protégés, s'il est possible par la cuirasse. Il est à souhaiter que l'on prescrive de comprendre cette étude dans les plans de constructions des bâtiments."

Antonio Rodriguez Braga, de Lisbonne, vondrait que les postes de secours soient "établis à peu de distance des combattants sur les différents ponts; ils devraient être bien protégés de toutes parts. Mais ces postes seraient difficiles à installer sur la plupart des cuirassés de combat. Cette impossibilité cependant n'existera plus si dans la construction des futurs navires de guerre on pense aussi bien aux conditions agressives et défensives du bâtiment qu'à celles de l'abri pour les combattants, et par conséquent puisque cet abri ne pourra jamais parvenir à l'invulnérabilité, aux exigences du service de santé en combat."

Le Médecin Général Schigemichi-Suzuki, de la Marine impérials japonaise, qui a pris part à toute la guerre navale avec la Russie en qualité de médecin d'escadre, a publié un fort intéressant rapport sur le fonctionnement du service de santé de la Marine japonaise pendant les hostilités.

Pour cet officier général, l'hôpital de combat idéal devrait avoir été prévu dans les plans du navire, être situé au-dessous de la flottaison, posséder un bon éclairage, une bonne ventilation et être muni des moyens nécessaires pour y amener commodément les blessés.

Comme je le disais au début de ce chapitre, l'accord sur cette question est chose à peu près réalisée parmi ceux qu'elle intéresse. La presqu'unanimité des médecins qui ont pris la plume à ce sujet, est d'avis que l'hôpital de combat doit être prévu dès la construction.

Ce ne sont plus les fonds du navire où les locaux sont privés d'air, où la chaleur est extrême, dont il faut faire choix. Sur les cuirassés, sur les croiseurs-cuirassés, les ingénieurs des constructions navales, les officiers de marine, sont avec nous pour déclarer que les hôpitaux de combat doivent être prévus dans l'entrepont cellulaire.

Cette conception a été sagement réalisée dans la Marine française par l'instruction du Sous-Secrétaire d'Etat en date du 18 février 1910.

L'Article XII de cette instruction édicte :

A l'avant et à l'arrière, à l'abri du pont cuirassé[1] sont disposées deux salles d'opérations destinées aux pansements compliqués et aux interventions graves pendant le combat.

Ces deux salles ont la dimension de la salle d'opérations du temps de paix augmentée comme il convient pour le logement de l'armoire et du lavabo; elles sont installées comme la salle d'opérations du temps de paix (carrelage, cimentage, dalots) et sont pourvues d'une ventilation artificielle énergique (dix renouvellements à l'heure) pour permettre au besoin l'usage du chloroforme; mais elles ne sont pas chauffées.

Autant que possible, les salles d'opérations protégées sont placées dans l'axe du navire avec une porte de 0.90 de chaque côté de manière qu'on puisse y introduire par un bord un cadre portant un blessé, et évacuer ce blessé sur les coursives protégées une fois le pansement effectué.

Les blessés pansés seront évacués dans les soutes situées au voisinage des salles d'opérations, sans qu'il soit nécessaire de faire aucune installation spéciale dans ces soutes.

III. DE QUELS OBJETS DE PANSEMENTS DOIVENT ÊTRE POURVUS LES POSTES DE PANSEMENTS?

Tout d'abord, établissons une distinction entre les postes de secours de l'avant et les hôpitaux de combat.

Les postes de secours de l'avant, devront le plus souvent assurer les premiers soins, les premiers pansements aux hommes qui seront atteints dans les casemates ou les tourelles, presque toujours par des éclats d'obus.

Comment donc secourir les blessés tombés à leurs postes de combat?

Avant de trancher la question, examinons ce que nous enseigne la pratique des champs de bataille et profitons de l'expérience acquise soit sur terre soit sur mer, pour doter nos postes de secours de pansements pratiques, rapides et propres, en nous rappelant que le précepte de Volkmann: "Le premier pansement tranche le sort du malade et décide de la marche ultérieure de la plaie," est toujours vrai.

Depuis 1892, époque à laquelle il nous fut donné d'assister à des combats meurtriers sur terre pendant la belle campagne du Dahomey, la question du premier pansement sur le champ de bataille a toujours été l'objet de nos préoccupations.

Au cours de cette expédition je confectionnais avant le combat des pansements tout préparés avec les objets qui se trouvaient épars dans les cantines médicales. Il n'y avait donc plus sous le feu de l'ennemi à se préoccuper de rechercher les éléments constitutifs d'un pansement.

Les pansements préparés à l'avance étaient appliqués sur les plaies avec une très grande facilité: un gros blessé prenait cinq à six minutes, un blessé léger de deux à trois minutes. Les hommes atteints par le feu de l'ennemi étaient toujours pansés quand il fallait reprendre la marche en avant.

Heureux des résultats que j'avais obtenus dans une guerre ou les blessés furent très nombreux, je fis tous mes efforts pour en faire bénéficier la Marine, et le 22 janvier 1903, j'eus la très grande satisfaction de voir rendus règlementaires sur les navires de guerre les pansements tout préparés tels que je les proposais, c'est-à-dire de trois grandeurs différentes.

Au cours d'une session du Congrès International de Médecine tenu à Lisbonne en 1906, j'ai eu l'honneur de développer la question des

pansements tout préparés pour le temps de paix et surtout pour le temps de guerre dans la Marine française.

Cette idée germée en France a fait de rapides progrès aussi bien chez nous qu'à l'étranger. Dans son rapport d'inspection générale pour l'année 1905, le Dr. Léo, médecin en chef de l'escadre du nord, citant l'opinion des médecins placés sous ses ordres, s'exprime ainsi :

Le Dr. Bellot résume l'opinion générale dans les termes suivants ; c'est dans le cas où l'on aura le temps de s'occuper de la blessure avant le transport du blessé que la supériorité du pansement tout préparé apparaîtra avec le plus d'évidence ; mais, elle n'en sera pas moins réelle lorsque le pansement aura été différé jusqu'à l'arrivée au poste des blessés. L'existence de trois types de pansements—grands, moyens et petits—permet de pourvoir à presque tous les traumatismes, quelles que soient leurs dimensions. On évitera avec ces pansements tout préparés les pertes de temps, les gaspillages, sans parler des souillures inévitables qui atteindraient les paquets de gaze ou de coton défaits à l'avance.

Le Dr. Gorron du *Henri IV* déclarait qu'en cas de combat les pansements tout préparés (système Barthélemy) rendront des services signalés et que dans les compagnies de débarquement ils ont une supériorité évidente, car its permettent au médecin, sans avoir à déballer tout son sac, de pouvoir procéder à un pansement excellent n'importe où, même sur le bord d'une route.

Les Médecins de la Marine Avérous et Brunet qui ont pris part aux tragiques et sanglantes journées de Casablanca des 5, 6, et 7 août 1907, au cours desquelles la Marine ajouta une page de plus à ses glorieuses annales, s'expriment ainsi dans leur si intéressant rapport, à propos de nombreux blessés qu'ils eurent à soigner.

C'est alors qu'apparut l'utilité des pansements tout préparés de divers types de Monsieur le Médecin Principal Barthélemy. Ne prévoyant aucunement une action offensive, nous n'avions rien emporté de plus que le sac d'ambulance. Il ne fallait pas songer à attendre qu'on put aller chercher de l'eau, qu'on la fît bouillir, qu'on eut des récipients convenables pour préparer des solutions, qu'on eut les moyens de s'antiseptiser les mains, de préparer le champ opératoire ou de tailler des pièces de coton. Trois mesures s'imposaient avec une urgence immédiate : protéger la blessure, la mettre dans des conditions permettant d'attendre proprement l'intervention, calmer les souffrances.

Grâce aux pansements tout préparés contenus dans le sac, en quelques instants les deux premiers désidérata furent remplis sur le champ.

Et plus loin ils ajoutent :

Les nouveaux pansements aseptiques tout préparés de nos coffres sont parfaits à tous les points de vue ; les blessés de Casablanca en ont retiré un bénéfice péremptoire ; tous ont guéri sans suppuration dans notre ambulance où tout était improvisé, où nous étions loin d'avoir l'entourage auquel nous sommes habitués dans nos salles d'opérations et où l'encombrement était relativement considérable.

En cas de combat à bord, les mêmes résultats sont donc à prévoir.

En France les navires de guerre n'ont pas été seuls à adopter les pansements tout préparés. La marine marchande les a rendus règle-

mentaires pour ses coffres à pansements, et l'armée les a compris dans les objets de pansements du temps de guerre.

A l'étranger l'idée n'est point restée stérile. N'avons-nous pas lu en 1905 dans le rapport du Médecin Général Schigemichi-Suzuki que les médecins de la flotte japonaise s'étaient servis au début des hostilités de petits paquets de pansements, et que les ayant trouvés trop petits le médecin d'escadre avait écrit au quartier général pour en avoir de plus volumineux pour les gros traumatismes causés par l'artillerie.

La Marine hollandaise a adopté vers 1905 des pansements tout préparés de Utermolhen. Ces pansements consistent en une compresse de gaze, une couche de ouate comprimée et de deux bandes fixées à la compresse. Le tout est plié de façon qu'on ne touche pas à la partie que sera en contact avec la plaie. Ces pansements de quatre dimensions sont contenus dans des boîtes en ferblanc placées dans les différents postes de secours pendant le combat. La distribution à bord des cuirassés est de 50 pour cent de l'équipage.

Le Dr. J. C. Wyse, que nous avons déjà eu l'honneur de citer plusieurs fois, a annoncé au Congrès de Lisbonne, en 1906, qu'une Commission d'Officiers de l'Armée et de la Marine Américaines avait été récemment nommée pour étudier la question du premier pansement et que cette commission, dont le rapport n'avait pas encore été publié, recommandait des pansements tout préparés nombreux pour les petites et les larges blessures.

L'année dernière j'ai eu le plaisir de me rencontrer dans des fêtes officielles, mais non moins cordiales, avec le distingué Dr. Miranda, médecin de la belle escadre italienne qui était venue à Bizerte saluer le Président de la République Française. Ce très aimable confrère, dans une charmante causerie, m'a appris que les navires de guerre italiens étaient tous munis de pansements tout préparés exactement semblables à ceux qui sont règlementaires dans la Marine française.

Après ce que nous venons d'exposer, il est permis d'affirmer que le pansement tout préparé constitue actuellement le pansement de choix du champ de bataille. Lui seul permet de panser rapidement un blessé; il évite les longs préparatifs d'un pansement ordinaire, les souillures des paquets de coton, de gaze etc.; il supprime le gaspillage inévitable.

Les pansements tout préparés ont déjà reçu avec plein succès le baptême du feu. Avérous et Brunet ne nous disent-ils pas qu'ils ont merveilleusement réussi à guérir les blessés de Casablanca.

Ne sont-ils pas tout naturellement désignés pour constituer l'approvisionnement des postes de secours de première ligne.

Les tourelles, les casemates, les blockhaus seront donc munis pour le combat: (1) De pansements tout préparés; (2) d'eau distillés pour étancher la soif des blessés; (3) d'une paire de forts ciseaux pour couper au besoin les vêtements; (4) de quoi arrêter les hémorragies.

Dans ces différents locaux, le règlement de la Marine française exige qu'il y ait au moment du combat : (1) Des bidons d'eau distillée ; (2) une musette à pansements comprenant quelques pansements tout préparés, une paire de forts ciseaux, deux lacs en treillis ; (3) des boîtes métalliques renfermant quatre pansements tout préparés type moyen.

Ces boîtes sont délivrées à raison de deux pour chaque tourelle et chaque casemate, et de quatre pour le blockhaus.

De quel matériel doivent être munis les hôpitaux de combat?

Ces formations sanitaires situées dans l'entrepont cellulaire, à l'abri des coups de l'ennemi, sont évidemment des organismes plus compliquées que les postes de secours de première ligne.

Les médecins qui y seront attachés devront pouvoir appliquer de rapides pansements aux blessés qui viendront les réclamer au cours de la lutte, pratiquer des opérations d'extrême urgence pendant les pauses ou les accalmies de combat, procéder à des pansements compliqués sur les hommes gravement atteints. Pour ces besoins multiples, n'apparaît-il dès maintemant que le pansement tout préparé doive encore jouer un rôle prépondérant dans les hôpitaux de combat?

Je ne puis mieux faire que d'énumérer le matériel chirurgical alloué par l'instruction du Sous-Secrétaire d'Etat en date du 18 février 1910 aux salles d'opérations protégées des grands navires de guerre français. Ces salles d'opérations prévues dès la construction du navire sont au nombre de deux, l'une à l'avant, l'autre à l'arrière dans l'entrepont cellulaire.

Elles comportent chacune un lavabo à une cuvette et une armoire pour le linge et le matériel de pharmacie. Elles comportent chacune deux lampes fixes de 30 bougies. Elles ne reçoivent en temps de paix aucun appareil du service médical, mais elles comportent les dispositifs nécessaires (prises de courant, tuyautage, etc.) pour qu'on puisse y installer avant le combat les appareils placés en temps de paix dans les locaux hospitaliers non protégés ou en soute, savoir (Provenant de la salle d'opérations non protégée) :

SALLE D'OPÉRATIONS PROTÉGÉE AVANT.

Le stérilisateur électrique ;
Une table à opérations système Auffret ;
Une table étagère métallique à pansements système Auffret ;
Un lavabo à pédales ;
Deux réflecteurs de 30 bougies ;
Une lampe à huile provenant de la timonerie.

SALLE D'OPÉRATIONS PROTÉGÉE ARRIÈRE.

Le bain-marie de la salle de visite ;
Une table à opérations embarquée au moment de la mobilisation ;
Le table étagère métallikue à pansements de la salle de visite ;

Le lavabo à pédales de la salle de visite;
Deux réflecteurs de 30 bougies (empruntés aux autres services du bord);
Une lampe à huile empruntée à la timonerie;
Les coffres à médicaments de la salle de visite seront placés avant le combat; dans la soute du service sanitaire ou au besoin dans une coursive.

Voilà pour le matériel chirurgical d'applique. Voyons maintenant la question des pansements:

Au moment de la mobilisation, un cuirassé ou un croiseur-cuirassé dispose, en dehors des objets de pansements ordinaires, de 658 pansements tout préparés de différentes grandeurs, calculées comme il suit: Type grand, 113; type moyen, 318; type petit, 227.
Respectable total, plus que suffisant même pour une guerre des plus meurtrières.

Dans la Marine le pansement tout préparé de différentes grandeurs est donc actuellement le pansement de choix, soit pour les postes de secours de première ligne, soit pour les hôpitaux de combat.

IV. FONCTIONNEMENT DES POSTES DE PANSEMENTS.—UTILITÉ D'ENSIGNER AUX HOMMES LA MANIÈRE DE SE SERVIR DES PANSEMENTS TOUT PRÉPARÉS.

Nous avons vu dans l'un des chapitres précédents qu'au moment où le combat s'engage, les œuvres mortes du navires sont inhabitées, les combattants étant enfermés dans les blockhaus, tourelles et casemates, tandis que les médecins et leurs aides occupent les hôpitaux de combat dans l'entrepont cellulaire.

Blockhaus et tourelles fourniront très probablement les premiers blessés, atteints par des éclats d'obus qui pénétreront par les rares ouvertures percées dans les murailles d'acier.

Les hommes occupant ces réduits ont à leur disposition des pansements de première urgence. Tout blessé, s'il n'est pas trop gravement atteint, se retirera dans un coin et du mieux possible, appliquera sur sa plaie un pansement tout préparé.

Si la blessure siège sur une région qu'il ne peut atteindre, ou si elle est trop grave, un des hommes de la tourelle lui portera rapidement secours et reprendra aussitôt après son poste de combat.

Au cours de la lutte, il peut arriver que l'explosion d'un projectile allume un incendie d'importance dans l'un des entreponts. L'équipe d'incendie, jusque là tenue en réserve sous cuirasse, recevra probablement l'ordre de venir combattre les progrès du feu. Pendant cette manœuvre, l'équipe est exposé à avoir des blessés ou des hommes intoxiqués par les gaz délétères; les uns et les autres seront immédiatement descendus aux hôpitaux de combat par leurs camarades ou des brancardiers appelés d'urgence.

Ces formations sanitaires qui pivotent autour des salles d'opérations protégées disposeront d'un local où les graves blessés attendront

leur tour pour être transportés sur la table d'opérations. Tout à côté une installation sommaire permetra à un infirmier de panser rapidement les hommes légèrement atteints.

Les gros blessés introduits dans la salle d'opérations, après avoir été opérés (en cas d'extrême urgence) et surtout pansés, seront évacués sur les soutes et les coursives voisines; des matelas, des lits y auront été préparés à l'avance pour les recevoir.

La lutte continue, les blessés deviennent plus nombreux dans les tourelles, les casemates; puis l'ennemi s'éloigne; pour différentes raisons le feu se ralentit sensiblement. A cet instant le commandant, toujours tenu au courant des gros incidents qui se seront produits dans les divers compartiments blindés, donne l'ordre d'évacuer les blessés sur les hôpitaux de combat.

Aussitôt le médecin en sous-ordre, les infirmiers, les brancardiers, munis des moyens de transport disponibles, se portent là où leur présence est nécessaire. Avec toute la rapidité voulue, ils dégagent les blessés, les chargent et les transportent soit à l'hopital de combat avant, soit à celui de l'arrière, selon leur proximité, selon surtout les échelles et les panneaux restés disponibles.

Peu à peu l'ordre s'est rétabli, les blessés ont été remplacés par des hommes tenus en réserve; de nouveau les escadres se rapprochent, et la lutte va recommencer plus acharnée que jamais.

Toujours sur ordre du commandant, seul juge de la situation, chacun a regagné son poste. Les hôpitaux de combat sont de nouveau en pleine activité. De nombreux blessés ont été descendus pendant l'accalmie, les médecins pratiquent maintenant les gros pansements, arrêtent les hémorragies, s'il y a lieu.

A une nouvelle interruption, ou à la fin de l'action, grâce aux pansements tout préparés qui ont permis d'aller vite en besogne, le terrain est déjà bien déblayé, et les victimes sont dans de bonnes conditions pour attendre des soins ultérieurs plus compliqués qui ne pourront être donnés que lorsque le calme sera complètement revenu.

Mais, pour arriver à cet heureux résultat, il est absolument indispensable que tout homme occupant un poste dans une tourelle, une casemate ou un blockhaus, soit capable de donner les premiers soins à un blessé. Ce n'est point là une instruction supplémentaire bien compliquée; donner à boire, appliquer aussi proprement que possible un pansement tout préparé, ne constituent pas des opérations au-dessus de l'intelligence de nos hommes. C'est donc dès le temps de paix que les médecins embarqués doivent donner cette instruction élémentaire aux équipages. Les marins seront particulièrement entraînés à manipuler les pansements tout préparés, à les appliquer sur des blessés fictifs, en se rapprochant autant que possible des conditions du temps de guerre.

Chacun possèdera un manuel du brancardier. Des récompenses, des points supplémentaires pour l'avancement stimuleront leur zèle. Les résultats que l'on peut obtenir sont excellents; j'ai pu m'en rendre compte sur certaines grosses unités, où comme médecin-major, j'étais chargé de l'instruction des brancardiers.

Transport des blessés.—Je serai bref sur le transport des blessés, cette question ayant été mise en discussion dans le programme du congrès et devant, par conséquent, être traitée à part. J'en dirai cependant quelques mots qui complèteront mon sujet.

Pour évacuer rapidement une tourelle ou un blockhaus encombré de blessés, pour que ces locaux soient complètement dégagés lorsque le canon reprendra ses droits, il nous faut des moyens de transport simples et pratiques.

Les puissances maritimes ont toutes adoptées des appareils présentant des avantages et des inconvénients.

En France nous possédons le brancard à compas modéle le l'armée, le hamac Guézennec et la gouttière Auffret.

Le brancard est inutilisable à bord sauf en direction horizontale, ce qui constitue tout-à-fait l'exception. On doit donc le réserver pour les compagnies de débarquement, où les équipages se trouvant dans les conditions des troupes à terre, il peut rendre d'utiles services pour le transport des blessés.

Le hamac Guézennec a été trop souvent décrit pour que je répète ici sa description. Il est commode par ce qu'il passe partout, mais l'installation d'un blessé y est longue et un fracturé ne s'y trouve pas à son aise, au contraire. Appareil de fortune, il est appelé à disparaître.

Reste la gouttière Auffret qui, à notre avis est l'instrument de choix. C'est un appareil dit Fontan, capable d'être apporté près du blessé, de le recevoir bien soutenu, accoré, afin qu'il puisse, fracturé de la tête, du fémur, ou du bassin, supporter le trajet presque saus souffrir.

Mais ces divers modes de transport avec des appareils spéciaux exigent un temps relativement long, soit qu'on se serve des panneaux, soit qu'on utilise les échelles pour l'évacuation des blessés sur les hôpitaux de combat. Aussi doivent-ils être strictement réservés pour les hommes atteints de délabrements considérables chez lesquels aucun autre moyen d'évacuation ne peut être employé.

Il est un moyen de transport qui a été tout particulièrement employé dans les dernières guerres maritimes, c'est le transport à bras.

Le regretté Dr. Thémoin, médecin en chef de la Marine, après une étude très documentée sur le fonctionnement des services de santé des Marines russe et japonaise, écrivait dans les archives de médecine navale:

"Si l'on considère les moyens qui furent employés pour transporter les blessés, on ne peut manquer d'être frappé du fait suivant, aussi

bien sur les bâtiments japonais pourvus de brancardiers exercés et d'appareils perfectionnés, qu'à bord des navires russes, où les porteurs étaient à peu près improvisés et les brancards très défectueux, le transport à dos ou à bras fut presque exclusivement adopté."

Personnellement je suis persuadé que c'est là un mode de transport auquel on aura le plus souvent recours parce que pratique et rapide.

Mais, tout comme pour les pansements tout préparés, il est de toute nécessité que dès le temps de paix les hommes y soient méthodiquement entraînés.

Cet entraînement portera surtout: (1) Sur le transport à bras par un seul brancardier (transport à dos, transport dans les bras); (2) sur le transport à bras par deux brancardiers, en position couchée pour le blessé.

Le manuel du marin brancardier, réglementaire dans la marine française depuis le 1er mars 1906, décrit tout au long ces procédés.

Une utile gymnastique consisterait à établir en escadre des joutes de transport des clessés à bras.

Pour nous résumer, disons que les blessés pouvant marcher se rendront seuls, ou accompagnés par un brancardier, à l'hôpital de combat. Les blessés qui pourront supporter le transport à bras y seront conduits par les brancardiers.

Seuls, les hommes gravement atteints, les fracturés du bassin ou des membres inférieurs exigeront le secours de la gouttière Auffret ou du hamac Guézennec.

C'est à dessein que je n'ai point parlé des divers incidents qui pourront souvenir soit dans les chaufferies, soit dans les machines. Ces compartiments se trouvant bien protégés, il sera toujours relativement aisé, à toutes les phases de la lutte, de remonter aux hôpitaux de combat, les blessés et les brulés.

Evacuation des blessés—Navires hôpitaux.—Le canon s'est tu; la bataille navale est terminée; les deux adversaires se sont définitivement éloignés avec des avaries plus ou moins graves. A bord, les médecins achèvent leur écrasante besogne. Sur certains bâtiments les blessés sont en grand nombre; des opérations graves s'imposent pour quelques-uns d'entre eux. Peut-on les tenter sur un navire qui vient de se battre pendant plusieurs heures, qui se prépare peut-être à recommencer le lendemain? Que va-t-on faire de tous ces blessés devenus à l'heure présente gros impédimenta pour les commandants?

Ici, comme sur beaucoup d'autres points, les nécessités de la guerre s'allient avec les lois de l'humanité.

Ces blessés, il faut coute que coute les débarquer, et tout naturellement se pose la question des navires hôpitaux, question également mise à l'ordre du jour et qui, je n'en doute pas, sortira de ce congrès complètement mise au point.

Déjà en 1906 le Congrès International de Lisbonne avait émis le vœu que tous les Gouvernements veuillent bien s'intéresser aux navires hôpitaux, à leur protection en temps de guerre.

Le Vice-Amiral Paschen, de la marine allemande, les considère comme indispensables aux escadres belligérantes.

L'Angleterre est entrée résolument dans cette voie. Le naval and military records du 14 février 1912 nous a appris que l'Amirauté avait décidé une importante addition à la flotte britannique, la construction d'un navire hôpital destiné à recueillir et à soigner les blessés et les naufragés. Ce sera le premier bâtiment dans le monde entier construit spécialement pour ce but. Muni de tous les aménagements désirables, des installations les plus modernes, son prix est fixé à 150,000 livres anglaises. Il doit être complètement terminé en un an, l'Amirauté désirant que ce navire soit en service passé ce délai.

Messieurs, j'ai terminé; comme je le disais au début de ma conférence, je n'ai point la prétention de clore définitivement le débat. Profitant de l'expérience et de tous les enseignements, mon ambition était de perfectionner les postes de pansements, afin d'assurer à tous nos marins frappés en défendant leur pavillon, des secours rapides et efficaces. Mon pansement tout préparé, né sur le champ de bataille, m'y a beaucoup aidé.

Je me suis efforcé à la fin de chaque chapitre de décrire les installations, les progrès qui avaient été réalisés et réglementés dans la Marine française. Mon grand désir serait, que dans un grand congrès comme celui-ci, les représentants des puissances maritimes apportassent, pour une si importante question, toutes les innovations rendues réglementaires dans leur Marine.

On aurait ainsi, pour les installations des postes de pansements de l'avenir, un choix de moyens qui servirait d'une façon très heureuse à leur perfectionnement.

Le progrès n'est pas l'œuvre d'un seul; il résulte de l'association des efforts de la collectivité, représentée ici par l'ensemble des nations civilisées.

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[1] C'est-à-dire dans l'entrepont cellulaire, encore appelé premier faux pont.

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SOME SANITARY PROBLEMS ON HOSPITAL SHIPS.

Surg. E. M. Blackwell, United States Navy.

I. SANITARY CONSIDERATIONS OF PERSONNEL.

1. On hospital ships there are many sanitary problems to be met and overcome that are not found on other ships of the Navy. The hospital ship might be called the clearing house for the diseases of the fleet, as all cases of any gravity are sent there, when the ship is with the fleet, and later returned to their ships or transferred to hospitals on shore. So every ship in the fleet has communication with the hospital ship, and the number of boats coming alongside and patients and visitors coming aboard far exceed that of any other ship in the fleet, not excepting the flagship. Consequently it is very necessary that the ship be kept clean, sanitary, and free from infection to keep the infection from spreading on the ship itself and to other ships.

2. The crew being composed of naval men and men of the merchant service, with patients from the various ships of the fleet, discipline is not so easy to administer and maintain, and sanitary regulations are harder to enforce than aboard a ship whose crew is entirely naval, homogeneous, and used to working together. New men for the merchant crew are constantly being shipped and discharged at short intervals. They come right from civil life, and often from insanitary surroundings, such as the slums near the water fronts of large cities. Many of them are foreigners and can not speak English, are undisciplined and not used to sanitary living, and they bring all kinds of dirty, vermin-infected clothes and baggage aboard. Furthermore, as no physical examination is required, they sometimes have infectious diseases.

3. To obviate any contamination or infection, every member of the naval and the merchant crew should be thoroughly inspected on coming aboard, and isolated, if there is any suspicion of contagious disease. All their clothes and other baggage should be fumigated before being stowed away.

4. The crew, both naval and merchant, should be examined at frequent intervals for concealed venereal or other contagious or infectious diseases.

5. Infectious cases should be kept on board only when it is impracticable to transfer them ashore, and they should be sent ashore just as soon as practicable, so as to minimize the danger of the spread of infection on the ship and to the fleet. A hospital ship stationed at the base of operations should establish an isolation camp ashore, as there would then be less danger of infection to the ship and the spread of infection to other ships of the fleet, and patients have much more freedom and are much more comfortable and fare better than in the necessarily cramped quarters aboard ship.

II. SANITARY FEATURES OF WARDS, BERTHING SPACES, AND OTHER COMPARTMENTS.

1. Wards generally should be located as high as practicable above the water line, and be light and airy, with good natural ventilation supplemented by artificial ventilation. There should not be, if practicable, over 30 beds to a ward. Cots in wards should be movable, so the wards can be entirely cleared out at times, and cots and compartments more easily cleaned and sterilized. Wards are generally not more than half filled with patients and, at such times, it would add much to the comfort of the patients and to the convenience of attendants if the surplus cots could be removed from the wards, thus giving more space, better light, and freer ventilation. A set of movable cots was devised and installed for trial aboard the hospital ship *Solace*, and they fully demonstrated their utility. Patients can

be transferred to other wards or different parts of the same ward in these cots, which can be used as litters, and the surplus cots can be stored overhead or be taken out of the wards entirely. Wards should not have to be used as passageways from one part of the ship to another, as it is a great annoyance to attendants and patients and makes wards harder to keep clean and sanitary and free from flies and vermin.

2. The isolation wards should be placed as far aft as practicable, and, as the ship usually heads up to the wind both at sea and in port, the effluvia, emanations, trash, refuse, and other sources of infection from the contagious wards and cases will be blown aft overboard rather than over the decks of the ship, as would generally be the case were the wards located forward or amidships.

These wards should have a sterilizing plant of their own or the main sterilizing plant of the ship should be very accessible to them. There should be 5 or 6 wards for the various classes of contagious diseases, ranging in capacity from 3 or 4 to 12 or 15 beds each. Each ward should be a separate unit in itself, not dependent upon any other ward.

3. All berthing spaces should have good natural and artificial ventilation, and therefore should be as high above water as practicable, so the ports can be kept open as much as possible when at sea.

4. All compartments should be capable of being easily hermetically sealed for purposes of fumigation, and so arranged that they can be opened from the opposite sides without having to enter the compartment after fumigation; and should have exhaust systems of ventilation which would carry the fumes outside the ship.

5. Large, light, and well-ventilated recreation rooms for convalescents are very necessary, so that these patients will not be compelled to stay in the wards except at night, thus lessening the annoyance to the bed patients and enabling the wards to be kept cleaner, neater, and more sanitary. There should be large open spaces on deck for exercise and recreation purposes.

6. The construction of the hospital department should be plain and simple, and cracks, corners, angles, inaccessible spaces, and ornamentations should be avoided, as they collect dust and harbor insects and vermin and make cleanliness and proper sanitation much harder to attain.

7. There should be large open deck spaces for exercise and recreation, and a well-equipped gymnasium would add materially to the comfort and efficiency of the ship.

III. MACHINERY FOR SANITARY PURPOSES.

1. The dynamos should be of sufficient power to run all the auxiliary machinery and to light the ship properly. It would obviate the necessity of leading steam pipes about the ship for the various ma-

chines and thus distributing wild heat to the different compartments. It would also obviate the nuisance and inconvenience of having leaky steam pipes to contend with, and would be much more sanitary.

2. The laundry facilities should be sufficient for the hospital department, officers, and Hospital Corps, as men doing hospital duty are often too busy to wash their own clothes and keep them in the condition they should be in when attending the sick.

3. Sterilizing plant should be large and convenient to laundry and isolation wards, and hospital linen should be sterilized before going into the laundry. There should be sterilizers for utensils convenient to wards.

4. There should be an incinerator centrally located for the destruction of garbage, discarded dressings, and trash, as the fireroom is generally very inaccessible, and is much more insanitary when used for such purposes.

5. There should be a central vacuum cleaning plant connected with all parts of the ship, so the dust, dirt, and trash could be sucked up and thrown overboard, and not stirred up on deck and in the various compartments to vitiate and contaminate the air.

6. The ventilating system should be installed with the greatest care. It should be large enough to supply abundant fresh air when everything is battened down at sea in rough weather, and should include both supply and exhaust systems.

7. Especial attention should be paid to the extermination of flies and vermin. The ship should be thoroughly screened. Experience with fluoride of sodium on the hospital ship *Solace* has demonstrated that it is probably the best and cheapest exterminator for roaches and ants.

8. Sanitary scuttle butts should be placed in different parts of ship. The sculleries should have the most modern and approved machinery for washing and sterilizing dishes and galley utensils.

9. It would be desirable, if practicable, to have a central fumigating apparatus with pipes leading to the various compartments, so they could be fumigated with sulphur or formalin without the inconvenience and danger of having to put the apparatus into the various compartments.

IV. COMMISSARY DEPARTMENT.

1. The commissary is probably the most important single feature aboard ship, and probably upon no one thing does the success and efficiency of the ship depend so much as upon a sanitary, well-organized, and efficient commissary department. The personnel of the commissary department should consist of enlisted men of the Navy rather than merchantmen.

2. The galleys and pantries should be centrally and conveniently located, and should be kept scrupulously clean and sanitary, as all are fed from these compartments, and infection is more liable to spread from these than any other source. Hospital galleys should be separate from crew's alleys, and supplemented by diet kitchens for the various wards. These places should be rigidly inspected every day. The personnel of the commissary division should be inspected at frequent intervals to see that they keep their person and clothes clean and have no contagious or infectious diseases.

3. No commissary can be successfully run without adequate cold-storage facilities for fresh provisions and proper storerooms for other stores. Cold-storage rooms with entrances by hatches through the deck above can be kept cold more easily, but are not as convenient or as accessible as those with doors in the bulkheads. They should be convenient to the galleys, and should be kept scrupulously clean. Galleys, pantries, and storerooms are the special habitats of flies, roaches, and other vermin, and special attention should be paid to keeping these places clear of them, thus minimizing the chances of spreading disease.

4. Wash rooms and toilet rooms of the crew and patients should be given special consideration in location and installation of apparatus to make them sanitary, and should be rigidly inspected, as these are special sources for the spread of infection.

DER EINFLUSS GESUNDER KEIMTRÄGER BEI DER VERBREITUNG DER SEUCHEN, MIT BESONDERER BERÜCKSICHTIGUNG DER TRUPPE IM FRIEDEN UND IM KRIEGE.

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Das Studium er gesunden Keimträger ist etwa 10 Jahre alt und zuerst im Typhusbekämpfungsgebiet des Deutschen Reiches in Angriff genommen. Eine grosse Zahl Veröffentlichungen über dieses Thema ist in dem Klinischen Jahrbuch, eine besondere ausführliche Zusammenstellung in Nr. 18 dieser Zeitschrift erschienen. Man nennt gesunde Keimträger Leute mit pathogenen Bakterien im Körper, ohne die für diese Krankheitserreger charakteristischen Krankheitserscheinungen. Diese Keime sind meist Bakterien, können aber auch Protozoen und höher organisierte Tiere, z. B. Würmer sein. Als Ansiedlungsstellen kommen für Bakterien in erster Linie die Schleimhäute, z. B. des Rachens, der Gallenblase, des Darmes u. s. w. in Frage, wo sie wohl stets mehr oder weniger örtliche Schleimhautveränderungen, z. B. Rötung, Verdickung, oft sogar Wucherungen und andere Entzündungserscheinungen hervorrufen.

Somit kann man streng genommen von gesunden Keimträgern eigentlich selten oder garnicht sprechen.

Unzweifelhaft kommen bei allen Infektionskrankheiten sogenannte gesunde Keimträger vor. Die Seuchenbekämpfung wird sich jedoch nur bei Erfüllung folgender Forderungen näher mit ihnen beschäftigen:

1. Neigung der Keime zur länger dauernden Ansiedlung im Körper.

2. Gefährlichkeit für die Umgebung.

3. Die Gefährlichkeit der ausgeschiedenen Keime muss den Nachteilen der anzuwendenden Massnahmen entsprechen.

4. Die Feststellung der Keimträger darf nicht zu schwierig und langwierig sein.

5. Nicht zu explosionsartige Zunahme der Infizierten, sodass noch eine bakteriologische Durchuntersuchung und andere sanitäre Massnahmen den Seuchenherd zu umgrenzen vermögen.

Meinungsverschiedenheiten über die Krankheiten, bei welchen die Berücksichtigung gesunder Keimträger noch in den Rahmen der Seuchenbekämpfung gehört, sind vorhanden und selbstverständlich. Die Bewertung der Keimträger wird in erster Linie durch die Biologie des Erregers bestimmt. In Bezug auf gesunde Keimträger sind in erster Linie bearbeitet: Genickstarre, Diphtherie, Typhus, Paratyphus, Ruhr, Cholera; kurz erwähnen möchte ich ferner, Influenza, Pest, Ankylostomiasis. Bei den genannten Infektionskrankheiten sind folgende wichtige Einzelheiten zu erwähnen:

GENICKSTARRE.

1. Erreger sterben durch Eintrocknen, ja durch blosses Abkühlen leicht; bei Tieren nicht haftend. Für die Uebertragung kommt nur der Mensch durch Nahinfektion: Speicheltröpfchen beim Husten und Sprechen in Frage, dagegen weder Tiere noch Gegenstände. Genickstarrehäuser gibt es nur, wenn Dauerausscheider oder Kokkenträger in ihnen wohnen. Nahes Zusammenleben, z. B. in Bergwerken, Kasernen, Massenquartieren begünstigt die Uebertragung, ferner Wohnungselend, Ueberanstrengungen, Erkältung und andere Allgemeinschwächungen.

2. Haften der Genickstarreerreger wird durch Rachenkatarrhe (Katarrh der Raucher und Trinker) besonders bei Miterkrankungen und Wucherungen der Nasenhöhle, ferner durch vergrösserte Mandeln begünstigt. Für die Weiterverbreitung sehr gefährlich sind die Meningokokkenbronchitiden und -Pneumonien. Das sprunghafte Weiterschreiten der Seuche wird durch Kokkenträger erklärt.

3. Die Persistenz der Kokken dauert nach der klinischen Genesung meist nur 2–3 Wochen, z. B. fand Lingelsheim nach 2 Wochen noch

bei 25 Prozent, nach 3 Wochen nur noch bei 10 Prozent Meningokokken. Wirliche Dauerausscheider sind an Zahl gering, vereinzelt von Trautmann bis 2, von anderen bis 7 Monate beobachtet.

4. Die Zahl der Kokkenträger ist gross, auf jeden Kranken sollen 2–10, nach anderen Autoren meist mehr, ja über 40 zu rechnen sein. Diese Angaben sind von der Technik, besonders aber auch von der Untersuchungszeit inbezug auf Epidemien (Anfang, Mitte, Ende) abhängig. Meyer stellte in epidemiefreier Zeit bei 9111 Soldaten 1.73 Prozent Kokkenträger fest, bei denen eine Beziehung zu Kranken nicht zu finden war. Auf Grund dieses Ergebnisses glaubt er an eine weite Verbreitung der Genickstarreerreger, auch unabhängig von Kranken und hält eine Durchuntersuchung auf Kokkenträger praktisch für zwecklos. Dieser Ansicht über Ubiquität des Meningokokkus widersprechen Flatten und Sachs-Mücke; sie behaupten, Keimträger gibt es nur im Zusammenhang mit Kranken und eine Weiterverbreitung im Geheimen von Kokkenträger zu Kokkenträger gehört zu den Seltenheiten. Durchuntersuchung soll möglichst rasch und ausgiebig erfolgen, um die Infizierten noch isolieren zu können, bevor ihre Zahl zu gross wird; denn auf der Höhe der oberschlesischen Epidemie hat man nach Flügge bei 3000 Kranken mit 30000 Keimträgern zu rechnen gehabt, deren Isolierung natürlich nicht mehr möglich war. Auf jeden Fall wäre es m. E. auch bei der Truppe verfehlt, die bakteriologische Durchuntersuchung, eine unserer wichtigsten Waffen in der modernen Seuchenbekämpfung, selbst aufzugeben; ein Fahnden nach Keimträgern schon zu epidemiefreier Zeit würde andererseits zu weit gehen.

5. Die oft beobachtete Meningokokkenpharyngitis ist als spezifisch anzusehen. Die dadurch erzeugte lokale Immunität erzeugt Stillstand der Erkrankung.

6. Meist werden Erwachsene Kokkenträger, während Kinder erkranken. Bei den grossen Epidemien waren von den Kranken zehn mal mehr unter 15 Jahren als darüber, die meisten unter fünf Jahren; Neigung, Kokkenträger zu werden und zu erkranken, entsprechen sich nicht.

7. Haften der Genickstarreerreger ist bei Kokkenträgern etwas kürzer als bei Dauerausscheidern. Eine Trennungsmöglichkeit zwischen gefährlichen und ungefährlichen Keimträgern, ebenso wie zwischen echten und Pseudo-Meningokokken gibt es nicht.

8. Kutscher und Sachs-Mücke empfehlen, zur bakteriologischen Feststellung der Genickstarreerreger polyvalentes Serum und Agglutination bei 55° 24 Stunden anzusetzen. Auszuschliessen sind Stämme unter halber Titergrenze und mit Zusammenballung bei 37° nach 24 Stunden in Kochsalzlösung. Oft erschwert schubweises Ausscheiden der Bazillen ihr Ausscheiden mehr. Besonders bei ersten Fällen Vorsicht in der diagnose! Empfehlungswert ist Selbstent-

nahme durch den Bakteriologen, Anlegen von Kulturen an Ort und Stelle und baldigstes Bebrüten der Platten. Beim Versand des Materials fast stets Absterben der Erreger. Blut zum Vidal natürlich versendbar. Immunstoffe bei Dauerausscheidern festgestellt, nicht bei Kokkenträgern.

9. Behandlung gesunder Keimträger ohne sichtlichen Erfolg, anscheinend wegen des schwer zugänglichen anatomischen Baues der Nasenschleimhaut. Vorgeschlagen sind Formalinzigaretten, Spray mit Pyocyanase, Inhalationen mit Ol. theribinthinae oder eingetrocknetem Serum und anderes. Auf jeden Fall empfehlenswert: Allgemeinkräftigung des Körpers, Beseitigung der Katarrhe, hierzu von Bethge empfohlen: 3 Prozent Perhydrol als Gurgelwasser ev. Beseitigung von krankhaft vergrösserten Mandeln.

10. Nach preussischem Gesetz ist im Zivil Isolierung der Dauerausscheider, nicht der Kokkenträger erlaubt, für diese nur Belehrung. Bei der Truppe werden alle Keimträger isoliert. Als Hauptgesichtspunkte kommen auch hier in Frage: Gut funktionierendes Meldewesen, möglichst rasches aber sachgemässes Eingreifen, nicht zu weit gehende, aber gut durchgeführte Massnahmen, Einschränkung des Verkehrs zwischen Zivil- und Militärbevölkerung bezw. zwischen den einzelnen Truppenteilen. Vermeidung grosser Ansammlungen und enger Quartiere. Wenn möglich, zweimalige bakteriologische Durchuntersuchung der Verdächtigen. Möglichst langes eventl. mehrmonatliches Fernhalten der Keimträger von der kämpfenden Truppe. Im Kriege muss Zwangsisolierung auch der Kokkenträger bei der Zivilbevölkerung erlaubt sein. Hauptgewicht ist jedoch stets auf Belehrung zu legen, z. B. für Zivil durch Zeitungen, öffentliche Anschläge. Bei allen Fällen in der Truppe sofortige Entsendung eines Hygienikers. Seitens des der Truppe im Kriege vorausgehenden Hygienikers ist nach etwa vorgekommenen Genickstarrefällen bei der Zivilbevölkerung zu forschen und Massnahmen sind von ihm zu veranlassen; das Ergebnis ist der nachfolgenden Truppe durch Umdruck bekannt zu geben. Ausgabe von alter Leinewand als Taschentücher, die nach Gebrauch zu verbrennen sind, an alle infizierten oder verdächtigen Truppenteile. Rauchverbot. Unter Aufsicht strenges Durchführen von Gurgeln und Zähneputzen, morgens und abends, vielleicht mit desinfizierenden Flüssigkeiten. Durchführen der Massnahmen 2–3 Wochen lang wird meist genügen. Vollständige Isolierung, auch im Freien, wird nur in allerseltensten Fällen notwendig sein. Gerade bei Genickstarre ist die beste Hilfe bei der Seuchenbekämpfung die Furcht jedes einzelnen, besonders bei bereits vorgekommenen Todesfällen. Meist ist Beruhigung noch mehr am Platze, als Betonen der Gefahr.

DIPHTERIE.

1. Der Diphteriebazillus gelangt ebenfalls in erster Linie wie der Genickstarreerreger durch Speichel- und Auswurftröpfchen, z. B. beim Sprechen, Husten, Niesen in die Aussenwelt; er ist zwar widerstandsfähiger wie dieser gegen Eintrocken, stirbt aber ebenfalls ausserhalb des lebenden Körpers bald ab. Als Zwischenträger kommen Haustiere: Taube, Hund, Katze, Kühe, ferner Taschentücher, Hände, Essgeschirre in Frage. Auch in der Milch hält sich nach Kersten der Diphteriebazillus lange Zeit, 2–6 Monate.

2. Enges Zusammenleben begünstigt die Uebertragung: Schulen-Kasernen. Die Virulenz nimmt bei einer Uebertragung von Bazillenträger zu Bazillenträger ab, bei Erkrankungen, besonders bei grösseren Epidemien zu. Geringe Bedeutung haben nach Löffler und Scheller die Pseudodiphteriebazillen.

3. Dauerausscheider häufig: Haften des Bazillus nach Löffler und Drigalski noch 3–4 Wochen bei 20–25 Prozent Rekonvalescenten, nach 7 Wochen 10 Prozent. Peip beobachtete noch Bazillen nach 20 Tagen nach Schwinden der Belege bei 14 Prozent der Rekonvaleszenten, nach 30 Tagen bei 8 Prozent, nach 60 Tagen bei 6 Prozent, nach 90 Tagen bei 0.6 Prozent, über 90 Tage bei 0.3 Prozent. Grössere Zahlen stellte Scheller fest. Also meist wochenlanges Haften der Bazillen. Einzelne Epidemien haben verschiedenen Character inbezug auf Virulenz und Persistenz der Bazillen. Bei der grossen Zahl der Dauerausscheider ist die Gefährlichkeit des einzelnen gering. In Kopenhagen wurden aus Krankenhäusern von 3.037 Rekonvaleszenten 700 mit Bazillen entlassen, von denen nur 8 in den ersten 4–12 Tagen Ansteckungen verursachten und zwar im Ganzen bei 82 Leuten.

4. Die Bazillenträgerzahl ist noch grösser, als die der Dauerausscheider; Ubiquität des Bazillus ist jedoch nicht anzunehmen. Scheller fand Diphtheriebazillen nur bei Leuten mit Beziehungen zu Kranken. Kober untersuchte 700 Kinder und fand 15 × Bazillen; nur 5 × = 0.83 Prozent ohne scheinbaren Zusammenhang mit Kranken; desgl. Stadler bei 464 Kindern 6 × —1.29 Prozent. Scheller fand bald bei etwa 40 Prozent, bald bei allen Angehörigen von Kranken Bazillen; während Epidemien sollen 7.6–9.4 Prozent der ganzen Grossstadtbevölkerung Bazillenträger sein: in Boston wurden 1 Prozent aller Schulkinder mit Bazillen behaftet gefunden.

5. Bei Bazillenträgern verschwinden die Bazillen rascher wie bei Dauerausscheidern. Katarrhe der oberen Luftwege begünstigen und verlängern das Haften. Kinder sind empfänglicher wie Erwachsene.

6. Diagnose leicht. Kultur stets erforderlich. Verwendung des Materials möglich. Nach Kretschmann befördert Quetschung der Tonsillen Diagnose und Behandlung.

7. Alle Mittel zur Heilung der Keimträger ohne sichtlichen Erfolg. Empfohlen sind von Schlippe Pyocyanase und Serumbehandlung, von Petruschky aktive Immunisierung mit abgetöteten Bazillen, von Scheller gegen Autoinfektion prophylaktische Seruminjektionen. Wichtig, Heilung der Kartarrhe. Nach Naether: 3 Prozent Wasserstoffsuperoxydlösung, nach vorherigen Gurgeln mit schleimlösenden Mitteln, z. B. 1 prozentiges kohlensaures Ammoniak, nach Löffler: Thymol, Benzoe, Eukalyptus oder Zitronenöl u. s. w.

8. Nach den Ausführungsbestimmungen zum Deutschen Seuchengesetz können gesunde Diphteriekeimträger im Zivil nicht isoliert werden. Seligmann will alle Keimträger aus Schulen und Anstalten ausmerzen. Lipmann befürwortet keine allzustrengen Massnahmen, aber aufmerksame Beaufsichtigung, um jederzeit eingreifen zu können. Zum ähnlichen Schluss kommt Sommerfeld, da Kontakt mit Bazillenträgern ausserhalb der Schulen nicht zu vermeiden sei.

9. Für die Truppe ist Absonderung der Dauerausscheider zu ordnen. Otto empfiehlt stets Durchuntersuchung der Umgebung und wiederholte Untersuchung der klinisch Geheilten. Beaufsichtigung der Stubenkameraden. Bei mehrmonatlichem Haften Entlassung. Im Felde ähnlich wie bei Genickstarre. aber erst bei gehäufteren Fällen weitergehende Massnahmen; sonst nur Belehrung und Beaufsichtigung.

TYPHUS.

1. Bazillus verträgt Eintrocknen. Doch auch hier in erster Linie der kranke Mensch gefährlich; eine grosse Rolle spielt: "Die unsaubere Hand," dann wichtig: Ungeziefer. Läuse, Flöhe, Fliegen, Haustiere, z. B. Ziegen, Gebrauchsgegenstände. Nahrungs- und Genussmittel, Wohnungen. Heiler und Ungermann haben im Gegensatz zu Scorda im Organismus der Ziegen niemals Typhusbazillen zum Haften gebracht und nie eine Ausscheidung derselben bei diesen Tieren beobachtet. Seuchenbekämpfung besonders von der Sauberkeit und Durchführung anderer hygienischer Massnahmen abhängig.

2. Im Südwesten des Deutschen Reiches 04/06 bei 6.708 Kranken 310 Ausscheider =4.62 Procent. Von den 310 Bazillenträgern wurden vor ihrem Bekanntsein 3.41 Prozent, nach ihrem Bekanntsein 0.7 aller Krankheitsfälle verursacht. Je nach der Zeit der klinischen Genesung 1–6 Prozent Keimträger; durchschnittlich 4 Prozent, nach 1 Jahr 1 Prozent, nach Fornet 0.9 Prozent. Kräftezustand, Lebensgewohnheit, Beruf, wichtig: Frauen mehr wie Männer, Kinder $\frac{1}{3}$ beteiligt. Bei einigen Fällen über 50 jähriges Persistieren der Bazillen beobachtet, länger bei Dauerausscheidern als Bazillenträgern. Ausscheidung im Stuhl und Urin, in ersterem die Zahl wechselnd, in letzterem enorm viele Bazillen.

3. Haften der Bazillen besonders in der Gallenblase und ihren Ausführungsgängen. Je höher der Darm untersucht, desto häufiger Bazillen gefunden.

4. Schwächung des Körpers: Hunger, Anstrengungen, Erkältungen, Menstruationen, Geburten begünstigen Haften und Persistieren der Bazillen.

5. Oft Bazillen nur so lange ausgeschieden wie Zufuhr von aussen.

6. Jahre- und Jahrzehntelang gesund gebliebene Keimträger können plötzlich an Autoinfektion erkranken.

7. Meist allmähliche Virulenzabnahme bei Keimträgern. Virulenzsteigerungen durch unbemerkt gebliebene Autoinfektionen erklärbar. Nach Leddingham 2.3–3.3 Prozent aller Erkrankungen durch Keimträger, nach Meyer $\frac{1}{3}$, nach anderen $\frac{1}{14}$. Nach Frosch 04/06 während einer Epidemie auf 1 Keimträger 1 Kranker. Nach Niprasch steckte ein Keimträger in 4 Jahren 31 Personen an.

8. Diagnose aus dem Urin meist leicht, schwieriger aus Stuhl, erschwert durch geringe Anzahl und schubweises Ausscheiden. Versenden des Materials möglich. Wichtig Blutkultur in den ersten fünf Tagen, Vidal nach der 2.–3. Woche; hiermit sind noch Leute mit symptomlosen Typhen feststellbar; diese werden dann oft später als Keimträger erkannt. Vidal bei stets gesunden Keimträgern unbrauchbar, ebenso Baktericidie, opsonischer Index; Leddingham fand jedoch häufig einen agglutinierenden Titer von 50–100.

9. Beseitigung der Bazillen aus dem Urin meist mit Urotropin, Borovertin und Hetralin gelungen; nach Nieprasch waren hiervon einmal 6×6.0 im Ganzen 216.0 gr. erforderlich; auch Imunisierung versucht. Beseitigung der Typhusbazillen aus dem Stuhl ohne Dauerfolg. Zahlreiche Mittel versucht, ebenso operatives Eingreifen nach Dehler.

10. Zwangsweise Absonderung in Preussen nicht erlaubt; nur Belehrung: Desinfektion, Reinhalten der Hände. Allgemeinkräftigung nach Erkrankungen. Typhus-Rekonvaleszenten-Heime von Meyer vorgeschlagen.

11. Bei der Truppe: Beschränktes Durchuntersuchen der Umgebung und des Wärterpersonals. Entlassung der Rekonvaleszenten erst nach dreimaligem negativen Befund der bakteriologischen Untersuchung, nach Brückner spätere Wiederholung nach Monaten und Jahren. Untersuchung der neueingestellten Rekruten und Uebungsmannschaften, welche früher Typhus überstanden haben, oder aus Typhusfamilien bezw. -häusern stammen. Entlassung der Keimträger. Besondere Aufmerksamkeit auf Küchen- und Kantinenpersonal. Einschränkung von Beurlaubungen nach verseuchten Orten. Reinhaltung der Kasernenhöfe, besonders im Sommer wegen der Fliegen. Spülen der Essnäpfe nicht im Freien, auch nicht Aufheben von Knochen und anderen Speiseresten, sodass Fliegen daran kommen

können. Im Felde Erforschung der Ansteckungsquelle, rasche Meldepflicht, Verbesserung der Trinkwasserverhältnisse, der Unterkünfte und Biwakplätze (Aborte), Belehrung. Nur bei gehäuften Fällen beschränkte, bakteriologische Durchuntersuchung von Truppenteilen.

PARATYPHUS.

1. Noch widerstandsfähiger wie Typhusbazillen; sonst ähnliche Verhältnisse. Häufig Mischinfektionen mit Typhus; Paratyphusbazillen häufig bei gesunden Schweinen, Rindern, Pferden in und auf ihrem Fleisch; ferner in Mehlspeisen nachgewiesen. Von Komma bei 102 Würsten 30 × Paratyphusbazillen gefunden. Jedoch höchst wahrscheinlich keine Ubiquität. Giftige Formen fast nur bei Leuten mit Beziehung zu Kranken.

2. Diagnose durch Bestehen spezifisch verschiedener Arten (A. B. C.), ferner durch Unmöglichkeit der Trennung von giftigen und ungiftigen Arten sehr erschwert; daher Vorsicht bei Bewertung der Befunde!

3. Frauen weniger wie beim Typhus zu Keimträgern disponiert. Persistieren wohl meist kürzer wie beim Typhus. Schubweises Ausscheiden beobachtet. Nach Meyer und Bofinger bei allen gehäuften Durchfällen auf Paratyphusbazillen achten. Prigge und Sachs-Mücke unterscheiden inbezug auf Keimträger 2 Gruppen: (1) Weniger häufig dauerndes Ausscheiden gefährlicher Bazillen mit gelegentlichen Autoinfektionen; (2) häufig (5 × an Zahl mehr) vorübergehendes Ausscheiden; daher nur bei gehäuften Fällen bakteriologische Durchuntersuchung. Sonst Massnahmen wie beim Typhus.

RUHR.

1. Erreger Amöben oder Bazillen. Amöbenruhr in Deutschland höchst selten. Die von Martini beschriebenen Fälle von Keimträgern wahrscheinlich chronische Fälle. Uebermittler sind: Fliegen, Insekten. Wasser, Nahrungsmittel. Bei der Bazillenruhr werden drei Arten unterschieden: (1) Der Giftigste, der Schiga-Krusse; (2) der Flexner; (3) der Y Stamm, der hauptsächlich in Deutschland vorkommt; noch andere Abarten sind beschrieben, z. B. von Lösener. Ausserhalb des Körpers wenig widerstandsfähig. Material schwer versendbar.

2. Bei allen Arten giebt es gesunde Keimträger. Autoinfektionen sind bei ihnen verhältnismässig häufig. Bei Ruhrzeiten sind alle Durchfälle als ruhrverdächtig anzusehen. Bei der Verbreitung der Ruhr spielen Fliegen eine grosse Rolle. Persistieren bei Dauerausscheidern bei 6 Prozent 6 Wochen lang; Simon fand bei 53 leichten Fällen nach 3 Monaten noch bei 4 Bazillen. Andere haben weitere, längere Ausscheidungen beobachtet. Meyer dagegen fand schon

nach der 1. Woche bei 82 Prozent, nach der 2. Woche nur bei 9 Prozent, nach der 4. Woche keine Bazillen mehr. Sitz der Bazillen sind meist Darmgeschwüre oder leicht blutende Schleimhautwucherungen des Darmes; wenn dieses sich bestätigt musste man "von chronischen Kranken," nicht von gesunden Keimträgern sprechen. Im Urin nie Ruhrbazillen gefunden. In Hagenau bei 171 Kranken 139 Bazillenträger, in Fürth bei 53 Kranken 22. Bazillenträger verhältnismässig ungefährlich.

3. Zur Heilung der Keimträger von Lentz Behandlung der Darmgeschwüre mit 2 Prozent Höllensteinlösung empfohlen, bezw. Eukalyptollösung oder Tanineinläufe. Diagnose oft in gesunden Tagen positiv, bei schleimigblutigen Stühlen derselben Leute negativ.

4. Nach preussischem Gesetz Absonderung der Keimträger bis 10 Wochen erlaubt. Fischer verlangt länger. Bei Keimträgern meist nur 16–20 Tage Ausscheidung.

5. Bei der Truppe bakteriologische Durchuntersuchung erforderlich. Aufhebung der Isolierung erst nach dreimaligem negativen Ergebnis, Meyer verlangt wenigstens viermal.

6. Im Felde ähnlich wie bei Typhus, Belehrung und Desinfektion, nur bei gehäuften Fällen innerhalb eines Truppenteils Absonderung und bakteriologische Durchuntersuchung in möglichst beschränkter Ausdehnung. Längere Beobachtung früherer Kranker, besonders zur Zeit der Sommerdiarrhoen. Frühere Keimträger nicht in die kämpfende Truppe wieder einreihen. Alle dünnen Stühle mit Blut, besonders wenn gehäuft, als ruhrverdächtig betrachten. Verlegung der Truppen aus verseuchten Lagern.

CHOLERA.

1. Choleravibrio ausserhalb des Körpers sehr wenig widerstandsfähig; in kälteren Gegenden fast ausschliesslich im Stuhl kranker oder gesunder Keimträger.

2. Persistenz der Bazillen meist nur bis 12 Tage, selten länger beobachtet, von Bürger bis 69, von Stühlern bis 90, von Zelatergenoff bis 93 Tage.

3. Vibrionenträger meist nur gegen Ende der Epidemie. Pfeiffer stellte 1905 bei 174 Erkrankungen 38 Vibrionenträger fest. Nach Marcowich zeigten von 15 Bazillenträgern nur 3 die Symptome der asiatischen Cholera. Ansiedelung meist in der Galle. Zahl der Keime bei festen Stühlen gering, bei dünnen enorm.

4. Bakteriologische Diagnose leicht, besonders mit Blutalkaliagar von Dieudonné.

5. Berichte über erfolgreiche Behandlung der Keimträger nicht vorhanden.

6. In Preussen dürfen alle Keimträger isoliert werden. Aufhebung der Absonderung nach zwei- bis dreimaligen negativem Ergebnis der bakteriologischen Untersuchung am besten nach Abführmitteln.

7. Bekämpfung bei der Truppe, besonders im Felde, ähnlich wie beim Typhus, nur entsprechend der grösseren Gefährlichkeit der Erkrankung mit strengeren, weitergehenden Massnahmen. Schon im Frieden sind Cholera-Kommissionen in Deutschland eingerichtet, um schon bei ersten Cholerafällen sofortige Massnahmen treffen zu können. Auch bei ersten Fällen sofortige Entsendung hygienischer Sachverständiger erforderlich.

PEST.

1. Erreger verträgt das Eintrocknen, im Eiter baldiges Absterben, von Vagedes allerdings noch nach 2½ Monaten aus ihm gezüchtet, daher Nah- und Ferninfektion möglich. Hauptüberträger: Ratten und Ungeziefer. Nach dem Sitz der Infektion wird unterschieden: Lungen- und Beulenpest. Nur Lungenpest ungeheuer gefährlich und leicht übertragbar.

2. Von Dauerausscheidern und Bazillenträgern noch wenig bekannt. Hoffmanns Bericht von der Pestkonferenz in Mukden 1911 erwähnt nur 1 Fall von Bazillenträger. Unklare Fälle stets auf Ratten zurückgeführt. Wochenlanges Ausscheiden nach Genesung von Lungenpest beobachtet.

3. Quarantäne dauerte in der Manschurei nur fünf bis sieben Tage.

4. Nach deutschen Zivilgesetzen können Kranke Dauerausscheider und Bazillenträger abgesondert werden. In der Pest-Konferenz in Mukden wurden Verkehrbeschränkungen als besonders wirksam hervorgehoben.

5. Genau so bei der Truppe. Für die Truppe fliegendes Pestlaboratium in Berlin, Altona und Königsberg gebrauchsfertig vorhanden.

INFLUENZA.

1. Erreger wenig widerstandsfähig. Fast nur Nahinfektion von Mensch zu Mensch.

2. Haften durch Allgemeinschwächung, z. B. Tuberkulose, Masern begünstight. Scheller fand während der Epidemie 1906–7 bei Tuberkulose-Kranken bei 33 Prozent; im Sommer darauf 1908 bei 3.3 Prozent, Winter 1908–9 bei keinem mehr Influenzabazillen, bei Nicht-Tuberkulose-Kranken: 1906–7 bei 24 Prozent, 1907–8 im ganzen nur noch 4 Bazillenträger. Keine Ubiquität. Aber Zahl der Infizierten nimmt meist so rapide zu, dass eine bakteriologische Durchuntersuchung und irgend welche Massnahmen unmöglich sind.

WURMKRANKHEIT, ANKYLOSTOMIASIS.

1. Larve des Ankylostomum duodenale in Gruben hinreichender Wärme ausserordentlich verbreitet. Enzystierte Larven gelangen aus dem durch Kot verunreinigten Wasser durch Mund und Haut in den Körper und durch den Stuhl nach aussen. Bruns fand auf 110 Gruben bei zehn- bis fünfzehnmaliger Durchuntersuchung 14,716. Diese Zahl sank durch systematische Thymolkuren auf 1,252.

2. Mikroskopische Durchuntersuchung mit Behandlung die beste Bekämpfungsart. Ferner, neben Thymolkuren der Infizierten Desinfektion der nur in Abortkübel entleerten Fäkalien.

Als allgemein wichtig ist hervorzuheben:

1. Gesunde Keimträger mit vorausgegangenen Krankheitserscheinungen nennt man Dauerausscheider, ohne solche Kokken-, Bazillen- oder Vibrionenräger. Die meisten Arbeiten aus dem Typhusbekämpfungsgebiet des Deutschen Reiches haben diese Worte in einer andern Bedeutung gebraucht; sie bezeichnen mit Dauerausscheider gesunde Keimträger bis 10 Wochen, darüber mit Bazillenträger. Eine Uebereinstimmung in der Nomenklatur wäre zur Vermeidung von Irrtümern dringend erwünscht.

2. Die Permanenz der Keime ist sehr verschieden, meist nur wenige Wochen, jedoch vereinzelt jahre- und jahrzehntelang, z. B. beim Typhus. Schwächliche oder geschwächte Personen neigen mehr wie kräftige oder nach Krankheit rasch gekräftigte Personen zu Keimträgern; ebenso machen örtliche Schleimhauterkrankungen empfänglicher, z. B. Rachenkatarrhe, Sommerdiarrhoen u. s. w. Erfahrungsgemäss sind neu zugezogene Leute in erster Linie gefährdet; dieses ist nur durch langsame Immunisierung der ständigen Umgebung zu erklären.

3. Die Ausscheidung der Keime geschieht in wechselnder Menge, oft nur schubweise, wodurch das Auffinden der Keimträger und die Feststellung ihrer bakteriologischen Gesundung ausserordentlich erschwert wird. In grosser Menge setzt meist die Ausscheidung bei akuten Erkrankungen der betreffenden Schleimhäute ein, z. B. bei Rachenkatarrhen, Magendarmstörungen.

4. Die Zahl der Keimträger ist bei vereinzelten Fällen im Anfange und am Ende von Epidemien gering, auf ihrer Höhe aber oft ungeheuer gross.

5. Die Ausscheider können an Selbstinfektion erkranken.

6. Die Giftigkeit der Keime nimmt bei völlig gesunden Keimträgern langsam ab, nimmt aber bei oder nach Erkrankungen und bei Epidemien meist zu.

7. Schutzstoffe werden fast stets vermisst; beim Vorhandensein sind sie auf vorhergegangene, vielleicht unbemerkt gebliebene örtliche oder allgemeine Krankheitsattacken zurückzuführen.

Allgemein lässt sich sagen, Ubiquität eines Krankheitserregers ist bisher noch nicht nachgewiesen. Gesunde Keimträger haben stets direkte oder indirekte Beziehungen zu Kranken.

Die Bedeutung der gesunden Keimträger, ihre Entstehungsart, ihre Zahl, und ihre Gefährlichkeit ist abhängig:

1. Von der Biologie des Erregers z. B. Widerstandsfähigkeit gegen Eintrocknen, Neigung zur Ansiedlung auf Haustiere.

2. Von dem Sitz der Ansiedelung im Körper und der Art der Ausscheidung. Hier kann man zwanglos zwei Gruppen unterscheiden: Infizierte, welche die Krankheitserreger haben: (1) Im Atmungsapparat; (2) im Verdauungsapparat.

Bei den Infizierten, Kranken und gesunden Keimträgern mit Bazillen in den Atmungsorganen, Lunge, Hals, Nasenrachenraum wird die Atmungsluft der Umgebung durch, Speichel-Tröpfcheninfektion, besonders beim Sprechen, Husten Niesen, mit Keimen geschwängert. Bei engem Zusammenwohnen in Kasernen, Schulen, Arbeitsstätten, Wirtshausleben, wird eine explosionsartige Zunahme der Infizierten eintreten. Mehr als Desinfektion nützt Belehrung, Einschränkung des unmittelbaren Verkehrs. Bei Vorsicht ist Zusammensein in frischer Luft (Felddienst) unschädlich. Unmittelbarer Verkehr, besonders in bedeckten Räumen ist zu vermeiden; ferner sind mit Speichel, Auswurf und Nasenausscheidungen infizierte Sachen z. B. Taschentücher zu desinfizieren bezw. zu vernichten. Die Uebertragungsart der Nahinfektion durch Speicheltröpfchen kommt in erster Linie, bezw. allein in Frage bei sehr widerstandslosen Erregern z. B. Menningokokken und auch wohl der Influenzabazillus, während bei solchen, die die Eintrocknung mehr oder weniger vertragen, sich also auf Gebrauchsgegenständen lebensfähig erhalten, oder ansiedlungsfähig auf Haustieren sind auch noch andere Ansteckungsquellen mehr oder weniger eine Rolle spielen, z. B. Diphteriebazillus und die Pesterreger.

Wesentlich anders verhält sich die Gruppe der Darmkrankheitserreger. Diese Keime gelangen mit den Ausscheidungen (Urin, Kot) nur periodisch mit den Ausscheidungen, meist Stuhl, in die Umgebung und trocknen mit ihrem Substrat fest, von dieser Gruppe sind allerdings einige ebenfalls gegen Eintrocknen ziemlich empfindlich, z. B. die Ruhrbazillen und Choleravibrionen, sehr wenig die Typhus- und Paratyphusbazillen. Wenn die Erreger dieser Gruppe aber auch das Eintrocknen vertragen, auch ansiedlungsfähig auf Haustieren sind, so können sie doch immerhin verhältnismässig leicht mit Desinfekionsmassnahmen erreicht und unschädlich gemacht werden. Das Wichtigste ist die Sauberkeit. Die Hauptrolle bei der Uebertragung spielt bei dieser Krankheitsgruppe "die unsaubere Hand," welche die Krankheitskeime unmittelbar auf sich oder andere Menschen überträgt, oder durch Vermittelung von Wasser, Milch,

Nahrungsmitteln verbreitet. Nur in letztgenannten Fällen haben wir mit einem explosionsartigen Ausbreiten der Keime, also auch mit einer grossen Anzahl von gesunden Keimträgern zu rechnen; meist wird die Infektion langsam und nur vereinzelt in die weitere Umgebung von Kranken gelangen. Eine gewisse Ausnahme macht der Paratyphuserreger wegen seiner grossen Ansiedlungsfähigkeit auf Haustieren, Wurst, Fleischwaren und sein häufiges Vorkommen in Mehlspeisen. Besonders wichtig ist die oft relative kurze Persistenz für gesunde Keimträger, z. B. bei Cholera meist nicht über 2–3 Wochen und das nicht sehr lange Haften bei Typhus, auch wohl Paratyphus. Bei der Seuchenbekämpfung dieser Krankheitsgruppe (der Darmkrankheiten) haben wir neben Belehrung, die Ausscheidungen, den Körper, besonders die Hände, die Bettwäsche, Bett und seine unmittelbare Umgebung zu desinfizieren und sauber zu halten, die Entstehung von Keimträgern ist zu verhüten; sind solche entstanden, kann mit denselben Massnahmen ihre Gefährlichkeit auf ein geringes herabgedrückt werden. Die Truppe ist immer wieder zu belehren und dazu zu erziehen, dass Sauberkeit der beste Schutz gegen Erkrankungen ist. Das Wichtigste der anderen Seuchenbekämpfung ist die Ermittelung der Ansteckungsquelle und eventuell die Isolierung der Infizierten. Die Ermittelung kann geschehen: (1) Durch Nachfragen (Verkehr, Wohnort); (2) bakteriologische Untersuchung und zwar in krankheitsfreien Zeiten, bei Einzelfällen und bei Epidemien. Zu berücksichtigen haben wir, dass Krankheiten bei der Truppe entstehen können:

1. Durch Einschleppung aus der Zivilbevölkerung, besonders (a) durch neueingestellte Rekruten; (b) durch Uebungsmannschaften; (c) bei der Mobilmachung.

2. Durch Keimverstreuung innerhalb der Truppen selbst. Wir werden also Nachfragen ohne bestimmten Krankheitsfall anstellen, wenn aus der Zivilbevölkerung neue Mannschaften eintreten, auch bei der Mobilmachung, ferner bei Belegung einer uns in hygienischer Hinsicht unbekannter Gegend. Die letzgenannte Aufgabe wird hauptsächlich den der Truppe vorausgehenden Hygienikern, auch den nachfolgenden Truppenärzten zufallen. Bei einzelnen oder gehäuften Krankheitsfällen der Truppen werden wir möglichst bald die Ansteckungsquelle durch Nachfragen zu ermitteln versuchen.

In wieweit sollen wir nun die bakteriologische Durchuntersuchung der Umgebung zu Hilfe nehmen? einmal zur Ermittelung der Ansteckungsquellen, dann zur Auffindung aller bereits Infizierten, besonders der gesunden Keimträger. Vom bakteriologischen Standpunkte aus müssten wir stets ausgedehnte bakteriologische Durchuntersuchung der Umgebung eines Kranken und Isolierung aller Kranken und gesunden Keimträger verlangen. Das ist aber weder

im Zivil noch beim Militär, am wenigsten im Kriege in allen Fällen durchführbar. Denn wie eingangs erwähnt, muss jede unserer Massnahmen dem zu erwartenden Nutzen entsprechen. In erster Linie ist hier die Geldfrage massgebend, besonders im Frieden. Dann aber auch haben wir Bedacht zu nehmen, dass möglichst wenig Störungen entstehen im Zivil, bei Handel und Verkehr, in der Truppe beim Dienst. Dieses gilt ganz besonders im Kriege. Hierbei ist besonders zu beachten: Die Zahl der zu erwartenden gesunden Keimträger ist nur in krankheitsfreier Zeit und bei Einzelfällen relativ gering, bei Epidemiezeiten enorm gross; eine bakteriologische Durchuntersuchung ist nur bei mehrmaliger Wiederholung einigermassen sicher; sie erfordert Zeit und bindet während der Untersuchungszeit die zu Untersuchenden an einen bestimmten Platz.

Oft vergehen im Felde noch dazu wohl meist Tage bis zur Ankunft und Arbeitsfähigkeit des Laboratoriums. Die Truppe mit einer grösseren Anzahl Entnahmegefässen zu versehen, würde zu weit führen, das Gepäck unnötig erhöhen und oft wenig Zweck haben, da gerade sehr wichtige Erreger, Genickstarre, Ruhr schwer transportfähig sind. (Dagegen wäre es vielleicht zweckmässig den Truppenteilen z. B. jedem Regiment einige Entnahmegefässe für Typhus, und Paratyphus (vielleicht je 10) im Manöver und im Kriege (um nicht zu hohe Belastung des Gepäcks zu veranlassen) mitzugeben. Was nun im Felde bei der Schwierigkeit bakteriologischer Durchuntersuchungen tun? Bei Einzelfällen gefährlicher Seuchen, Cholera, Pest, haben sofort ausgedehnte Massnahmen, auch bakteriologische Untersuchung mit Isolierung der gesunden Keimträger einzusetzen. Bei den andern Erkrankungen werden wir bei Einzelfällen unsere Seuchenbekämpfung nach unserer jeweiligen Kenntnis über die Verbreitungsart der einzelnen Krankheiten einrichten müssen, und zwar unter besonderer Berücksichtigung der Frage, inwiefern wir mit gesunden Keimträgern und ihrer Gefährlichkeit zu rechnen haben. Hierzu gehört aber eingehende Kenntnis jedes Truppenarztes, auch der der Reserve über die einschlägigen Fragen. Zusammenstellung in Form von Merkblättern über die Bedeutung der Bazillenträger die in ausgedehntem Masse zu verteilen wären, würden gegebenenfalls von grossem Nutzen sein; auch in dem Fortbildungs-Unterricht für Sanitätsunteroffiziere müsste die Bedeutung gesunder Keimträger beim Unterricht eingehend berücksichtigt werden. Als wichtigste Massnahme würden demnach zunächst im Kriege zu ergreifen sein:

1. Meldung jedes Krankheitsfalles an eine Zentrale, z. B. Korpsarzt, zur Vermeidung nicht unbedingt norwendiger Schreibarbeit nicht an militärische und militärärztliche Zwischeninstanzen. Für diese Meldungen keine bestimmte Form, möglichst nur Meldekarten, Telegrammstiel, Zahlenangaben.

2. Erzwingung hygienischer Massnahmen der Zivilbevölkerung, besonders Reinlichkeit; Beschränkung des Verkehrs, in erster Linie mit der Truppe.

3. Häufige Gesundheitsbesichtigung gefährdeter Truppenteile und wiederholte Belehrung.

Derartige Leute welche in der letzten Zeit eine Infektionskrankheit durchgemacht haben oder aus verseuchter Umgebung (Haus, Familie, Arbeitsstätte) stammen, müssten dem Truppenarzt stets bekannt sein, um sie und ihre Umgebung beobachten zu können; gegebenenfalls müsste bakteriologische Untersuchung ihrer Ausscheidungen ein oder mehere Male erfolgen. Gesunde Keimträger sollte man stets absondern und sie auch nach mehrmaliger bakteriologischer Untersuchung nur dann zur Truppe entlassen, wenn nicht erfahrungsgemäss bei der betreffenden Erkrankung das Haften der Keime oft Jahre- und Jahrzehnte dauert; denn mit schubweiser Ausscheidung ist stets zu rechnen. Einmal festgestellte gesunde Keimträger, z. B. bei Typhus, Paratyphus, und Ruhr sollen m. E. nicht mehr bei der kämpfenden Truppe, sondern nur im Innlande Verwendung finden.

SCHLUSSSÄTZE.

1. Gesunde Keimträger mit vorausgegangenen typischen Krankheitserscheinungen nennt man Dauerausscheider, ohne solche Kokken- oder Bazillenträger. Einheitlichkeit in der Nomenklatur ist anzustreben.

2. Nur bei einer beschränkten Anzahl von Infektionskrankheiten können und müssen wir auf gesunde Keimträger bei der Seuchenbekämpfung Rücksicht nehmen. Diese sind: Genickstarre, Diphterie, Typhus, Paratyphus, Ruhr, Cholera; geringere Bedeutung haben sie bei Influenza.

3. Fast bei allen Keimträgern hat sich eine Beziehung zu Kranken finden lassen. Ubiquität ist bei keinem Krankheitserreger nachgewiesen.

4. Die Zahl gesunder Keimträger ist in epidemiefreien Zeiten, sowie im Beginn und Aufhören von Epidemien meist gering, auf der Höhe der Epidemie meist enorm hoch. Deshalb sind nur frühzeitige Massnahmen zweckentsprechend möglich.

5. Die Gesamtheit der Keimträger bietet eine grosse Gefahr, der einzelne eine verhältnismässig geringe; nur die wenigsten verursachen Erkranungen. Bei Kenntnis der Keimträger ist die Gefahr nur eine verschwindend kleine.

6. Wichtig für die Seuchenverbreitung sind die Biologie der Erreger und die Art ihrer Ausscheidung. Danach kann man unterscheiden: (a) Krankheiten die ihren Sitz in den Atmungsorganen

haben und deren Erreger in erster Linie in Speicheltröpfchen beim Husten, Niesen, Sprechen (Genickstarre, Diphterie, Lungenpest) in die Umgebung gelangen, (b) mit ihrem Sitz in den Verdauungsorganen, deren Erreger hauptsächlich im Stuhl und Urin ausgeschieden werden: Typhus, Paratyphus, Ruhr, Cholera.

Bei Gruppe *a* ist Einschränkung des unmittelbaren Verkehrs, bei Gruppe *b* Sauberkeit als wichtigste Richtschnur gegenüber Kranken und Keimträgern geboten.

7. Ferner hängt die Verbreitungsart von der Empfindlichkeit gegen Eintrocknung und von der Ansiedlungsfähigkeit der Erreger auf Haustieren, Fliegen und Ungeziefer ab. Man unterscheidet Nah- und Ferninfektion.

8. Das Wichtigste bei der Seuchenbekämpfung besteht in der möglichst raschen Ermittelung der Ansteckungsquelle, daneben in der Auffindung von Keimträgern. Jenes erreicht man hauptsächlichst durch Nachfragen, dieses durch bakteriologische Untersuchung der Umgebung des Kranken.

9. Im Kriege sind wir meist auf sachgemässe Nachforschung und Ermittelung ohne bakteriologische Untersuchung angewiesen. Jeder Truppenarzt soll über die Bedeutung gesunder Keimträger bei den einzelnen Erkrankungen genau orientiert sein. Auch ohne bakteriologische Untersuchung muss er bei der Seuchenbekämpfung mit der Möglichkeit ihres Vorhandenseins rechnen können.

10. Aus der Zivilbevölkerung können Krankheiten in die Truppe verschleppt werden durch (1) Verkehr, (2) neueingestellte Rekruten, (3) Uebungsmannschaften, (4) im Mobilmachungsfall.

11. Die Massnahmen richten sich nach der Gefährlichkeit der Erkrankung; sie sollen sich besonders im Kriege stets auf das Allernotwendigste beschränken, aber stets auf das Genaueste durchgeführt werden. Kriegerische Operationen sind so wenig als möglich zu stören.

12. Hygieniker und Truppenärzte sollen möglichst nur allgemeine Richtschnur für ihr Handeln erhalten; keine Einzelheiten. Gerade auch die Bedeutung der Keimträger lässt sich für die einzelnen Fälle meist nur durch Prüfung der Verhältnisse an Ort und Stelle beurteilen. Meldungen und Berichte sind nach Zahl und Form zu vereinfachen und einzuschränken.

13. Ermittelte gesunde Keimträger, besonders bei Typhus, Paratyphus und Ruhr sollten wegen der Gefahr des schubweisen Ausscheidens auch bei wiederholtem negativen bakteriologischen Untersuchungsergebnis nicht wieder bei der kämpfenden Truppe, sondern nur im Heimatlande Verwendung finden.

14. Für Stuhl, Urin und Blutproben sollte jeder Truppenteil und jede Formation eine beschränkte Anzahl Versandgefässe erhalten.

DAS LAGER VON KRASSNOJE-SSELO IN SANITARER BEZIEHUNG.

Surg. Gen. Dr. Simon von Unterberger, Privy Councillor, Honorable Physician to His Majesty's Court, St. Petersburg, Russia.

Schon bei den ältesten Völkern begegnen wir Lagern. Die Juden errichteten Lager, als sie aus Egypten durch die Wüste zogen; den Griechen waren nach Homer die Lager ebenso bekannt und Xenophon gibt Beschreibungen der Lager bei den Persern. Den Höhepunkt der Entwicklung der Lager fanden wir bei den Römern.

Ständige Lager sehen wir in Frankreich und zwar am Ende des XVIII. Jahrhunderts; im Jahre 1793 in Bidasso und im Jahre 1794 in Dünkirchen. Von den ständigen Lagern ist hervorzuheben das Lager von Boulogne, in welchem 100,000 Mann Platz fanden.

Russland beschränkte sich zuerst auf das ständige Lager um St. Petersburg. Am 15. Mai 1733 rückten Gardetruppen ins Lager und zwar das Preobaschenskische Regiment in den Admiralitäts-Stadtteil, das Ssemenowsche, Ismailowsche und Ingermanlandsche in dem Stadtteil jenseits der Neva Wassilji-Ostrov.

Krassnoje-Sselo, dieser grosse Sammelplatz von Elitetruppen in der Jetztzeit wurde zum ersten Male im Jahre 1765 benutzt als dort auf Befehl Katharina der zweiten am 14. Juni Manöver bestimmt waren, welche im Jahre 1819 wiederholt wurden. In den letzten Jahrzehnten befanden sich im Lager von Krassnoje-Sselo ca. 40,000 Mann.

Krassnoje-Sselo ist von St. Petersburg 25 Werst entfernt. Von der ersten Station der Baltischen Bahn, die nach Oranienbaum und Reval führt, Ligowo zweigt der Weg ab südwestwärts in der Richtung nach Reval und geht anfangs in einer flachen Gegend, um auf der Hälfte des Weges bei Krassnoje-Sselo plötzlich stark zu steigen. Diese steile Erhebung ist der sogenannte Glint, der sich bis nach Reval hinzieht. Von der Höhe dieser Erhebung beginnt das Plateau, auf welchem das ganze Lager sich befindet.

Das Lager beim Dorfe Krassnoje-Sselo mit den anliegenden Dörfern, wo die Kavallerie und die Artillerie sich befinden, nimmt einen Flächenraum von ca. 200 Quadratwerst ein. Auf der einen Seite des Plateaus gibt es Erhöhungen bis zu 160 F., wie der Duderhof, weiterhin die Erhöhungen von Kirchhof 140 F. und Kawelachta 120 F. Auf der anderen Seite Kaporskoje, das beim Beginn des Glints anfängt und Schungorowo erreichen 120 F.

Inmitten des Hauptlagers liegen drei durch Absperrung künstlich angelegte Seexn, die ihren Ursprung in dem Quellengebiet des Duderhof'schen Berges nehmen, um weiterhin, erzeugt durch geologische Bildungen zuerst gleichsam bergab als schnellfliessender Bach, Ligowka, nach St. Petersburg parallel der Eisenbahn, zu fliessen,

wo er schliesslich dort in der Ebene in einen flachen Kanal endet. Der dem Duderhof'schen Berge zunächst gelegene See liegt 75 F. und der zunächst der Station gelegene 68 F. über dem Meersspiegel. Dank dieser Höhendifferenz ist die Strömung im dritten See so stark, dass hier eine Papierfabrik florieren kann.

Auf dem hohen Ufer der Seeen in östlicher Richtung liegt das sogenannte grosse Gardelager. Auf der gegenüberliegenden Seite das sogenannte Avant-Lager mit Armee-Regimentern und Militär-Lehranstalten. Auf dem grossen Plateau zerstreut, aber nicht weiter als 10 Werst vom Exerzierplatz liegen die Kavallerie-Regimenter. Das riesige Uebungsfeld von circa 5 Quadratwerst, wo auch die grossen Paraden abgehalten werden, schliesst sich an das Avant-Gardelager und auf der höchsten Erhebung liegt der Kaiserhügel mit dem Kaiserzelt, wo bei den Paraden die Truppen vor dem Zaren vorbei defilieren.

Auf der rechten Seite der Seexn liegen die kaiserlichen Villen, die Verwaltungsbehörden, das Hospital, das Theater.

Das Gelände des Lagers von Krassnoje-Sselo gehört in geologischer Beziehung zu den ältesten Formationen. Das grosse Plateau des Lagers gehört der silurisch-cambrischen Formation, ist reich an Unguliten-Kalkschichten, Sand und blauem Lehm. Die Bildung des Plateaus ist den Einwirkungen der Eisperiode zuzuschreiben, wo grosse Eismassen, aus Scandinavien kommend, die Kalkschichten auf Lehm fortrückten, wobei sich Faltungen nach allen Richtungen bildeten, die wiederum mannigfache Risse erhielten. Diese Faltenbildungen haben dann die Veranlassung gegeben zu Erhebungen, die als Hügel und Berge sich jetzt präsentieren.

Die Flora ist auf den Anhöhen durch kräftige Fichten, Tannen und Birkenbäume vertreten, ebenso Ahorn, Eichen und wilden Nussbaum. Unter den Gräsern sind zu nennen Oxalis Acetosella, Tussilago farfara, Trientalis Europea, Anemone nemorosa et hepatica. Dank dem schönen kräftigen Graswuchs ist in Krassnoje-Sselo die Milchwirtschaft sehr entwickelt.

Die Luft im lager ist rein und schön. Der vorherrschende Westwind mildert die Sommerhitze.

Das Gelände des Lagers besteht, wie wir oben gesehen, aus blauem Lehm, Kalk- und Sandschichten und alluvialem Geröll und ist mit üppigen Grase bestanden. In trockener Jahreszeit ist auf der Landstrasse viel Staub, in nasser ist der Boden glitschig, trocknet aber schnell aus.

Dank den radioactiven Eigenschaften des blauen Lehms und des Wassers ist der Gesundheitszustand der Bevölkerung ein guter. Epidemische Krankheiten wie Typhus oder Cholera finden keinen Boden; die eingeschleppten Fälle werden isoliert und eine endemische Verbreitung findet nicht statt.

Das Concentriren von circa 40,000 Mann an einem Orte wirft selbstredend die Frage auf " wo " und " wie " ein Lager errichtet sein muss, damit dem sanitären Zustande Genüge geleistet werde. Wird diese Frage nicht mit der nötigen Energie ventilirt und ihrer Lösung entgegengeführt, so kann sich im Lager leicht der Boden zur Entwicklung epidemischer Krankheiten bilden. In dieser Hinsicht sei daran erinnert, dass schon Moses, als er die Israeliten in die Wüste führte, viele beachtenswerte Regeln festgesetzt hatte; so, z. B., musste jeder Israelit eine Schaufel mit sich führen, um seine Exkremente zu vergraben. Jeder, der seine Notdurft innerhalb der Grenzen des Lagers befriedigte, galt als unrein; es wurde ihnen verboten, vor 7 Tagen ins Lager zurückzukommen.

Der Erdboden als solcher kann, trotzdem das Lager sich seit vielen Jahren dort befindet, durchaus nicht als verseucht gelten. Die Lagerzeit dauert etwa 5 Monate; 7 Monate also ruht der Boden und reinigt sich auf biologischem Wege. Wir wissen ja jetzt, dass sogar in dicht bevölkerten Städten auf circa 4 Meter Tiefe das Wasser steril ist, so energisch geht ja der biologische Reinigungsprozess vor sich.

Die Vorbeugung der Verunreinigung des Lagers besteht in einer systematisch durchgeführten Abfuhr der Exkremente durch die Landbevölkerung. Da die Aborte sich meist in 800 F. Entfernung von den Zelten befinden, werden zur Nacht zum Uriniren Tonnen in der Nähe der Zelte aufgestellt.

Im Lauf von Jahrzehnten sind nicht alle Abzugskanäle und Gräben, welche die Abwässer führen, stets mit der nötigen Energie gereinigt worden, weshalb sich an vielen Stellen Stauungen bilden, die zuweilen zu Zersetzungen und Gestank Veranlassung gegeben haben. Jetzt ist diese Frage nach eingehender Behandlung spruchreif geworden: man schreitet zu einer Kanalisation mit Bildung von Kollektoren und biologischen Filtern; das Abwasser aus dem Filter wird in den Fluss Ligowna geleitet.

In den Dörfern ist die Frage der Vorbeugung einer Verseuchung des Bodens schwieriger zu lösen, weil die Landbevölkerung noch recht primitive Einrichtungen der Aborte besitzt. Streng ausgeführte, regelrechte Abfuhr und Desinfektion spielen auch hier in der Vorbeugung der Verseuchung des Lagerplatzes eine hervorragende Rolle.

Die Wasserversorgung des Lagers ist im Grossen und Ganzen als sehr günstig zu bezeichnen. Ausser Quellwasser in überreichem Masse, besitzt das Lager artesische und gewöhnliche Brunnen der Landbevölkerung, zuweilen mit einer Tiefe von 37 m. mit gesundem Trinkwasser. Schlecht gehaltene Brunnen werden stets umgebaut oder durch neue ersetzt.

Im Lager sind drei grosse Quellengebiete, die gegen 1 Million Eimer frisches, kühles, schmackhaftes Trinkwasser liefern. Da das

Wasser der Quellen nicht so captirt ist, wie es die neuesten Forderungen der Bakteriologie erheischen, auch die Leitungsröhren einige Defekte aufweisen, somit das Trinkwasser bakteriellerseits nicht vollkommen einwandsfrei ist, so hat man bereits mit Umbauten angefangen, um auch den scrupelösesten Anforderungen der Bakteriologie gerecht zu werden.

Im menschlichen Leben spielt je das Wasser eine hervorragende Rolle. Das Wasser dient nicht nur als Nährstoff, sondern auch als Mittel zur Stärkung unseres Organismus gegen Krankheiten, ebenso wie eine kräftige Nahrung, Sonnenlicht und reine frische Luft. Bäder und Douchen regulieren die Blutzirkulation in allen Organen und erzeugen eine normale Osmose in allen Zellen, und dort hat der Bazillus meist keinen Boden zu seiner Entwickelung.

Zur Hygiene der Haut gehört auch reine Leib- und Bettwäsche, daher ist eine gute Waschküche eine unentbehrliche Einrichtung, sie kann ja meist eine Desinfektionskammer ersetzen; auf diese Einrichtungen wird jetzt grosses Gewicht gelegt, daher ist bei der Wasserversorgung 10 Eimer a Person pro Tag gerechnet worden.

Wo viel Wasser ist, da ist mehr Reinlichkeit. Wo Reinlichkeit ist, da ist kein Raum für epidemische Krankheiten.

Das Lager besitzt eins der hüsbschesten Hospitäler, die ich gesehen. Auf einer Anhöhe mit schöner Fernsicht, umgeben von Parkanlagen und geschmückt mit Blumenbeeten, befinden sich einetagige Holzbaracken und grosse und kleine Zelte. Das Hospital kann circa 600 Kranke aufnehmen. Soldaten mit akuten Infektionskrankheiten werden nicht aufgenommen, sie werden nach St. Petersburg evakuiert. Ein Drittel aller Krankheiten repräsentieren immer Brustleidende, die aus der Stadt evakuiert werden, damit sie sich in frischer Luft erholen können. Kriegschirurgische Krankheiten sind jetzt meist ersetzt durch Operationen civilen Charakters, wie Appendiciten, Bruchoperation, u. s. w.; die vor circa 30 jahren häufig vorgenommenen Amputationen und Resectionen kommen jetzt selten vor. Epidemische Krankheiten wie Typhus, Paratyphus, Cholera, sind stets aus St. Petersburg, dieser Stadt aller Infektionskrankheiten, durch Bazillenträger eingeschleppt. Derartige Kranke werden sofort isoliert, so dass eine grosse Verbreitung epidemischer Krankheiten über das ganze Lager nicht stattfindet.

Das Hospital besitzt ein gutes Laboratorium, eine Apotheke, ein Zahncabinett. Die Küche ist vorzüglich, die Milch tadellos. Ausser dem grossen Hospital befinden sich bei jedem Regiment kleine Lazarette bis zu 20 Betten; sie bestehen aus Holzbaracken und Zelten und in diesen werden leichte Erkrankungen behandelt.

Das Lager von Krassnoje-Sselo mit viel Luft und Wasser und Boden, reich an radioactiven Eigenschaften kann somit in sanitärer Beziehung als sehr begünstigt bezeichnet werden.

THE PERSONAL HYGIENE OF THE SOLDIER MAN FROM THE VIEWPOINT OF HIS OFFICERS.

JOHN VAN RENSSELAER HOFF, A. M., M. D., LL. D., Colonel, United States Army (retired).

"Let me have men about me that are fat; sleek men and such as sleep o' nights," said Cæsar. "Those with a lean and hungry look think too much and sleep too little."

"A great subject with officers should be to keep those committed to their charge in good health. There are precautions to be taken and rules to be attended to, the results of experience, which it is now disgraceful in an officer to be ignorant of." (Lord Wolseley.)

We are fortunate to-day in our appreciation of the fact that military hygiene is really a part of military education, and that the care of troops in a state of health is quite as much, if not more, the business of the line than the medical officers.

To meet this responsibility all officers are now required to study and pass in military hygiene, for promotion, thus gaining for this important subject a standing with the military body which it never before had.

But, while line officers must know the practical side of the care of troops, they also must know too many other things to permit all of them to devote much time to the theory of military hygiene, hence this is relegated to the medical staff, which is the aid and advisor of the commanding officer. Of course, the commander, whatever his rank, and only he, determines the application of the aid and advice, and, no matter whether he accepts or rejects them, he alone is responsible.

Much there is in the situation, arrangement, supply, and administration of the soldier's environment that is of great importance, but, after all, it is not so much the habitation as the man who occupies it that must be considered, if the best fighting results are to be obtained.

Assuming that the recruit is endowed with a sound body and a reasonably receptive mind, and also assuming that his officer has the gift of being able to manage him and his fellows, what is the first duty of the officer to this man, whom the Government has placed in the hollow of his hand, to make or mar as a soldier?

Teach him right living under the conditions of miltary life; then he will be able to march to the front or flank (the substance of drill), and shoot straight, for he will neither march nor shoot long if he does not know how to care for his own health. In a word, teach him how to preserve his health under service conditions.

The personal sanitation of the individual elements of a military body is of particular importance because, for military purposes, training, discipline, interior economy, etc., they are crowded into a

comparatively limited space. It is too well known to be disputed that disease and death are directly proportioned to density of population and uncleanliness of surroundings. Hence it follows that, since a military population must of necessity be dense, its sanitary safety lies in cleanliness.

That cleanliness does not instinctively appeal to the human animal is evidenced by the fact that he is naturally dirty. Cleanliness and order are acquired habits, and much of the time of the officer is taken up in teaching the many who join the Army how to get clean and keep clean in body, barracks, and camp. Hence the necessity for the endless round of inspection, a necessity all good housekeepers recognize and which, if omitted, even for a single day, will leave its mark in some trifling neglect. Uncorrected, these will soon increase in geometrical proportion, and particularly is this the case in active service.

From the foregoing it follows that the basic principle on which the soldier's efficiency depends is cleanliness. Cleanliness of person, place, air, water, and food.

But what does this mean? Webster defines cleanliness as the state of being habitually clean. In the light of modern scientific discovery it may be defined as freedom from harmful germs, and herein lies the essence of the proposition.

Everywhere about us on the earth, in the air, and water, within and without the body, are numerous seeds so infinitesimally small that millions of them can be held on the tip of a single finger. These seeds are harmless or harmful. Some have no appreciable effect and some produce the most malignant diseases; some protect and some assault the body. Between these germs active warfare is constantly being waged and, so far as the citadel of the body is concerned, the attack must ultimately win. But whether it be an easy or a hard victory will depend largely upon the care given the citadel (the body) itself.

The first lesson to be taught the recruit is in personal cleanliness. The surface of the body must be kept scrupulously clean.

General regulations of the United States Army deal with this phase of personal sanitation in a sketchy way under Interior Economy of Companies, paragraph 286, requiring that strict attention will be paid by company commanders to the cleanliness of the men and to the police of barracks or tents. The men will be required to bathe frequently and to wash their hands after going to the latrines and before each meal. The hair will be kept short and the beard neatly trimmed. Soiled clothing will be kept in the barrack bag, and it is made the duty of noncommissioned officers to see that these things are done. Paragraph 283 requires that the company commanders shall "make a daily inspection of the men's quarters and kitchens,

giving particular attention to cleanliness and the proper preparation of food."

These extracts constitute a text for a sermon on personal hygiene which the officer should unceasingly preach to his men and lay to heart himself; for example is always stronger than precept.

Strange to tell, a well-known writer on hygiene says: "It is hardly necessary to impress upon intelligent people the importance of personal cleanliness, for such is a matter of almost natural instinct." This is not so with soldiers, certainly not in active service, nor do I believe it is instinctive in other humans. Our writer adds: "In the case of the naturally dirty, the attempt to educate in this particular is, as a rule, a hopeless task, and with such the maintenance of cleanliness of body and surroundings can be obtained only by compulsion."

Those who have had experience in recruiting duty need not be told that the class of humanity seeking enlistment in the military service is not always of the alleged instinctively clean grade. Hence the necessity that officers give strict attention to the bathing habits of their men, for "bathing is of importance to health, not only for its action in removing dirt and infectious matter of external origin, but for its influence in keeping the skin free from waste products of the system and in condition for the proper exercise of its natural functions; for the skin is one of the most important natural defenses."

It is important that, among the standing orders in every company in barracks, should be one prescribing the minimum number of baths each man must take weekly, and a record should be kept of the bathings. The necessity for an occasional body inspection is imperative, and to-day in the United States Army the biweekly physical examination is general.

Orderliness of personal belongings and surroundings is also of the utmost importance to the military community, and this is best effected by absolute uniformity. The bedding should be disposed of in a certain way, preferably folded, and laid upon the uprolled mattress. This insures the shaking of sheets and blankets at least twice daily, as well as the airing of the mattress. The lockers should always be packed uniformly, and the clothing and shoes brushed before being put therein. The soiled clothing should invariably be kept in the barrack bag, and bedding and clothing should be sunned and aired weekly. Rules covering all points of interior economy should be posted in the barracks, so that none can plead ignorance of these requirements.

The obligation of the company commander to be particularly solicitous as to the food of his men is everywhere recognized as of the highest importance. Six paragraphs of general regulations are devoted to this subject, in which the company commander is especially charged with the supervision of the cooking and the messing of his

men. Nothing adds more to the contentment of a company than a good mess. If men are satisfactorily fed, the amount of effective work which can be gotten out of them is practically limitless; but if they are well fed, they must be well worked, or the balance will not be maintained, and the laziness of plethora will result.

In peace time, military life is idealistic rather than realistic. The soldier is constantly fighting a hypothetical enemy, and the largest part of the officer's duty is to make work for him, and see that he does it, so that when a real enemy appears he will be "fit." But, though his enemy is mostly imaginary, his stomach is very real and imperatively demands attention. Regarding the soldier man simply as a machine, we know that a certain number of pounds and ounces of food should produce a certain number of foot tons of work; but we must not forget that there is a palate to be consulted, and also the food habits of the man. So it is impossible to lay down hard and fast rules for the conduct of a mess, and he is happiest in results who comes nearest the average requirements of all his men. Nevertheless, there will always be kickers, and these are best disposed of by a detail as cook's police. It goes without saying that the dietary should be ample, varied, and wholesome; that it should be eaten in sufficient but not excessive quantity, and in an orderly and deliberate way. Nor should it be forgotten in this connection that clean teeth are indirectly an important factor in good digestion, and that dirty cooking utensils have poisoned men to death.

The personal habits of the individual are matters of great consideration.

Tobacco is harmful to the average adult only when it is abused, as it is likely to be by the cigarette fiend.

Wine, women, and song represent the ideals of youthful pleasure, and though the soldier man may, without great difficulty, be persuaded to give up song, he quite persistently adheres to his other ideals, oftentimes to his undoing. No one can question the value of temperance nor that disease is often the indirect result of drink. An ideal army would be one without vices, but, as we can not hope for such, it is our duty to make the one at hand as near ideal as possible.

A controllable license is the best we could hope for, but as Congress has deprived us of this, there remains nothing but precept, persistence, and punishment, until finally we may succeed in bringing the average soldier man up to the congressional standard of sobriety. Certainly no officer wants a drunkard in his company, for there can be no more undependable creature than such, except that he can always be depended upon to get drunk in every emergency.

The natural instinct of the adult animal is to perpetuate his race—he mates and propagates. In the ranks of the Army such mating is

usually of a very temporary character, and the propagation is too frequently of diseases peculiar to the disciples of Venus. We can not hope to wholly eradicate venery, but we can reduce the habit by hard work, and the danger by cleanliness.

Some one has said that the soldier man "is most amenable to advice, provided it is given with a 'sweet reasonableness,' and not forced upon him 'by order.' Point him out the better way, and sympathize with him in the trials and difficulties which beset him, and half the battle is won." However, see that he obeys orders. The following order embodies the most recent views of the War Department regarding the care of troops:

GENERAL ORDERS, No. 17. WAR DEPARTMENT, *Washington, May 31, 1912.*

1. It is enjoined upon all officers serving with troops to do their utmost to encourage healthful exercises and physical recreation, and to supply opportunities for cleanly social and interesting mental occupations for the men under their command; to take advantage of favorable opportunities to point out, particularly to the younger men, the inevitable misery and disaster which follow upon intemperance and moral uncleanliness, and that venereal disease, which is almost sure to follow licentious living, is never a trivial affair. Although the chief obligation and responsibilty for the instruction of soldiers in these matters rest upon company officers, the medical officers should cooperate by occasional lectures or other instruction upon the subject of sexual physiology and hygiene and the dangers of venereal infection.

2. Commanding officers will require that men who expose themselves to the dangers of contracting venereal disease shall at once upon their return to camp or garrison report to the hospital or dispensary for the application of such cleansing and prophylaxis as may be prescribed by the Surgeon General. Any soldier who fails to comply with such instructions, if found to be suffering from a venereal affection, shall be brought to trial by court-martial for neglect of duty.

3. Commanding officers will require a medical officer, accompanied by the company or detachment commander, to make a thorough physical inspection twice in each month of all the enlisted men (except married men of good character) of each organization belonging to or attached to the command. These inspections will be made at times not known beforehand to the men, and preferably immediately after a formation. The dates on which the physical inspections of the various organizations are made will be noted on the monthly sanitary reports.

At these inspections a careful examination of the feet and footwear and of the condition of personal cleanliness of the men will be made, as well as careful observation for the detection of venereal diseases.

After food, rest.—There is no such thing as perpetual motion within the limits of the spheres, and certainly not within the human machine, for which a period of rest both of body and mind is indispensable. The usual question is, Soldier, will you work? rather than rest, but, under certain conditions, there is no work so terrific as that of the soldier. Ordinarily eight hours for work, eight hours for rest, and eight hours for recreation is a formula which can be safely fol-

lowed with the average man, be he soldier or civilian. A due amount of physical exercise is essential to health and is a sine qua non for a soldier.

Mark this fact: A soldier must be an all-round athlete if one expects from him the best fighting results. The effort involved in physical exercise produces its effects, not alone upon the muscles, but upon the lungs and heart as well; in fact, all the tissues and organs respond. There is no subject a knowledge and practice of which is of more importance to a company officer than the physical training of his men.

Cleanliness of the soldier's habitation is almost as essential as cleanliness of his person. What if his barrack has all the modern conveniences and is constructed in accordance with the most advanced ideas if it is dirty and ill-kept? There is no truer saying than that dirt breeds disease. An effectively policed hovel is safer than a foul palace, and, if we wish to keep our men well, we must insist upon the surface cleanliness, not only of their bodies, but of their habitations and surroundings as well.

This does not mean the weekly flooding with water of the floors of his dwelling sometimes to the depth of inches, and the subsequent sweeping out of the water often through holes in the floor, in the hope that it will carry out the accumulated dirt, thus saving the elbow grease which little water and larger muscular effort would demand. Nothing is better known than that flooded floors invite disease, and such should be absolutely interdicted.

Dusting should be done with a damp cloth, and not a dustbrush, for dust is germ laden and should not be stirred up.

Great care should be taken to prevent the clothing worn through the day from being thrown carelessly about the squad room at night, to befoul the air, and possibly infect the sleepers. Nor should we forget to see that the squad rooms are properly ventilated day and night, so that each occupant shall get his full requirement of oxygen. The heat should be shut out of the squad rooms at night and warmth maintained by adequate bed clothing.

But let us now consider the military molecule from the standpoint of his alleged normal condition, war, and assume that he is starting out as a recruit in an active campaign. Theoretically, being an American citizen, he should know how to take care of himself; but, practically, no matter how intelligent under civil conditions, recent experiences have taught us that when he assumes the gun he grows utterly oblivious of all the rules of healthy living. He renounces his individuality, or rather transfers his responsibility therefor, and becomes the victim of circumstances over which he has no control. These "circumstances" are his officers. If they know how to order his military life, fortunate it is for him; if not, then will be repeated

the story of the fever camps, until, through dearly bought experience, is learned the rule of right living.

Don't let us again forget to change camp frequently, and when the military situation permits scatter divisions, brigades, regiments, and take as much room as practicable for individual tents, for crowding should never be permitted if it is avoidable. This and the providing of occupation, suitable clothing, proper food, and pure water are particularly the business of the officer.

Let us see what the man must do.

As stated, the soldier is required by regulations to bathe frequently and wash his hands before meals and after stooling, keep his hair short, beard trimmed, his soiled clothing in a barrack bag, the other clothing in good order, and the barrack or tent clean. This is the law and the gospel from which our "military resources" must evolve, the whole scheme of soldier sanitation. The professional soldier, of course, learns it through daily experience, precept, and example. But what of our recruit member of a recruit company of which a recruit officer is in command, or possibly a regiment or brigade of recruit companies for which this officer is responsible? Would his officer tell him, in the language of the regulations, to bathe and shave, and nothing more? Did he so, the result would be as effective as that which followed the effort of a certain officer who rode from tent to tent of new arrivals in a camp of concentration crying: "Boil the water; boil the water!" when the men had no utensils suitable for that purpose, and even had they, would not have known how to use them.

Systematic instruction in personal hygiene to such an organization in the beginning is paramount to any other instruction, and no higher duty can devolve upon a company commander than to know and to teach his men how to preserve their health, for upon health more than upon anything else depends the efficiency of his organization.

Personal cleanliness in the field is not easily maintained, and, unless the requirement is absolute, there will be no spontaneous effort on the part of the great majority of enlisted men to be clean. Very little water is actually necessary for a bath, and a canteenful with a wash cloth judiciously used will cleanse the entire surface of the body. Particular attention should be given to the folds and flexures. Lacking water, an air bath and dry rub will promote cleanliness. The time for bathing is after the day's work is accomplished. In the morning a damp towel for the face and a hand wash, if possible, are all that are requisite. Close-cropped hair and beard demand no attention except to be treated as is the rest of the surface of the body.

A word as to the pack, premising our remarks by the statement that the soldier should not be permitted to have anything except what is absolutely necessary, and this he should be required to have.

In campaign a soldier man must have a number of things to make him effective, about 50 pounds of them, now prescribed in orders. If the order is not strictly followed, he will sometimes overburden himself, especially in the beginning, with nonessentials, but oftener he will be without those things he actually needs.

Report has it that we have at last found a satisfactory knapsack, but in active service we will probably again accept the blanket roll as the only thing our soldiers will carry. With this we should certainly adopt some sort of an oblong linen case to contain the underclothing and which could be rolled in the blanket. This would cost little, weigh less, and be a great comfort to our men, as it would prevent the scattering of the contents of the roll every time it is opened. A section of barrel hoop placed in the roll where it rests on the shoulder holds the pack away from the chest and back, thus permitting much-needed ventilation at these points.

The care of the feet can not be neglected. Napoleon is alleged to have said that an army travels on its belly. I am quite sure that it would not go far without feet. In fact, Saxe, one of his marshals, said: "The secret of war lies in the limbs of the soldier." It is estimated that the disability from sore feet in the first days of an untrained marching command is from 20 to 30 per cent, of which 10 per cent will require medical aid, while the constantly noneffective from this cause, even in armies of which the soldiers are actually trained in marching, is by no means negligible. It need hardly be said that the common causes of sore feet are blisters, bunions, corns, chafing, and bruising, and it is an important part of the duty of the company commander to instruct his men how to prevent these conditions, and, if not preventable, how to relieve them.

General orders now require the company commander to make it his personal duty to see that each and every man has always ready at least one pair of well-fitting and serviceable shoes. These shoes should be kept soft and waterproof by a suitable dressing. A French army surgeon has called attention to suint, an impure wool fat, which he recommends as most useful not only as a foot grease but as a shoe dressing as well. The stocking should be of wool or merino, which makes a soft cushion for the foot and at the same time absorbs the perspiration; in which connection attention is invited to the value of the German foot powder of soapstone. Brown soap is also recommended as a lubricant.

On the march the soldier man should never be permitted to soak his feet, particularly in cold water. They should be wiped off with a damp cloth after the day's march is completed. Blisters should be evacuated by thrusting in a clean needle at the lower edge and then covered with a piece of adhesive plaster. The leaving of a piece of

thread in the blister to act as a drain is not recommended. If the blister becomes infected and degenerates into an ulcer the man will be lost to the service for many weeks. Hence the necessity for the utmost cleanliness. Bunions are caused by pressure on a joint, particularly the great-toe joint, and are relieved only by removing the pressure. Corns are also produced by pressure; they should be pared and, so far as practicable, the pressure removed. Chafing is relieved by adhesive plaster and bruising with tincture of iodine or iron. When the skin is badly broken French surgeons envelop the foot in a woolen cloth and break an egg in the shoe, thus making a hermetical dressing. The stockings should be changed after the march, aired, dried, and then beaten to get rid of dirt. They should be washed frequently.

There is scarcely anything in the way of personal hygiene that is more important than the care of the feet. The infantry officer certainly should be as solicitous for his men's feet as is the cavalry officer for his horses' hoofs. The neglect to properly care for the feet is a military offense in the German Army. Munson thus describes the sanitary inspection of the German soldier's feet:

> The method of making this inspection is to form the company in squads, standing upon tables or benches sufficiently high to bring the feet directly under the eye of the inspecting officer, usually the captain, and to bring under his observation any wincing or flinching when the inspected man jumps on the ground barefooted. The inspector passes down the line carefully examining the front of the feet and legs, which are bared to the knees, searching for strained tendons, blisters, improperly cut nails, or untrimmed corns. This completed the men are faced about, the *tendines Achillis* carefully examined, and the soles inspected, as they raise one foot and then the other. As the man passes from the table or the bench he leaps to the ground and runs to his shoes and stockings; this is to show any bruised soles or periostitis of the ankle.
>
> At the same inspection each man's socks, or "Fusslappen," and boots are carefully examined as to their condition.

A neat soldier will make himself presentable even under the most adverse circumstances, to do which requires that his clothing be cared for. In the field, as elsewhere, "a stitch in time saves nine." The company commander should insist upon a weekly mending and washing day, during which the entire wardrobe should be put in order.

The bellyband has been much discussed in our service during the last few years, and regarding it there is a wide diversity of opinion. I am a believer in the abdominal binder when properly used. It is not necessary even in the Tropics, when the abdomen is properly protected by other means, as is usually the case with our soldiers when up and about. The danger to be avoided is the exposure of so large a surface of the body, as that of the bared belly to the air, thus causing rapid evaporation of the perspiration and sudden cooling of the abdominal contents. The time to wear the bellyband, especially in the Tropics, is at night.

In spite of the most persistent watching the company commander will find his men and sometimes even himself infested with vermin. Then at once must be instituted a struggle for a quiet life. Any disinfectant will destroy lice. If the pest takes the form of "crabs," an ointment of carbolized vaseline or mercury will quickly relieve the situation. All clothing permitting it should be boiled and the rest should be cleaned within and without with soap and water, if benzine or steam is not available.

There is much in favor of waterproofing all military outer clothing, and if the Government will not do it the company commander can, at very little cost. The new issue of cotton khaki is water repellant, but I do not think the olive drab is. Munson says that a cent's worth of acetate of alumina will render a suit of clothes water repellant. The importance of this matter, both from a sanitary and a military standpoint, is worthy of consideration. No one can question that a soaking rain will add several pounds to the soldier's burden if his clothing is not water repellant, nor doubt that this extra weight could so retard his march that the fate of an important military movement might turn on this single factor. On the other hand, it goes without saying that the individual's physical well-being and comfort must be greatly promoted by dry clothing. But impermeable waterproof clothing of rubber or other like material has many disadvantages, and even the poncho in hot weather soon becomes unendurable.

The soldier's habitation while in the field demands quite as much or even more attention than his barracks in the post. Of this Wolseley says:

> Were the commanding officer of a regiment in any future war to order his men to dig large holes and pitch their tents in them, as was done by a genius before Sebastopol, a court-martial would be justified in finding him guilty of the murder of those who died in consequence.

One thing we must bear in mind; that is, that the average man will take many chances of danger from other causes rather than go cold; hence we must endeavor to keep our soldiers as comfortably warm as the conditions of health and other circumstances will permit. I shall not attempt to dwell upon the various improvisations which soldiers have made use of, especially as winter quarters. Many excellent forms have been devised, the choice of which will be determined by various conditions, but do not let him burrow except as a last resort; live above ground as long as possible.

The care of the tent is very important, for its cleanliness and orderly arrangement necessarily contribute to the comfort and health of its occupants. Do not let the men sleep directly on the ground if avoidable, but if they must, be sure that the poncho is spread beneath, and upon straw, leaves, or other available material. If the camp is at all permanent, improvise a bunk, which can be done, with ingenuity

and very little material. It is important that soldiers should be provided with mosquito bars, at least with head nets, in a mosquito country, and that they should be required to use them, especially at night, for the malarial mosquito flies by night. If these are not available, certain essential oils, such as pennyroyal, are obnoxious to mosquitoes, and a smudge is always at hand. Do not forget that mosquitoes are dangerous. Keep the tent adequately ventilated, for crowd poison is equally as active in a tent as in a house. It should be frequently turned or pitched inside out for sunning.

The proper disposal of the soldier-man's personal wastes is of the utmost importance, especially in more or less permanent camps, and in this the recruit requires particular instruction. Anyone who recalls the great camps of mobilization of the Spanish-American War, which, in their inception and execution, embodied every sanitary sin in the decalogue, will not soon forget the sinks, nor hardly blame the men for avoiding them. Teach your men how to make a sink, how to conserve it, and why they should use it, and the toilet paper which is now issued. Provide receptacles for urine to be conveniently distributed in the company street at night and enforce their use. Nor should we forget that the natural position of the human animal in defecating is to sit on his heels, not on a seat.

Forbid the eating of anything except that furnished by the company commissary or exchange. Indiscriminate eating and drinking are the bane of a recruit army, and a large factor in the causation of disease. Encourage the use of cold tea or coffee in the canteen, chiefly because this requires the drinking of boiled water. Bad water is so common throughout the world that in time the human race will treat it as it does its other food—by cooking; for, after all, cooking is an acquired taste, and the time must have been when our simian ancestors ate their food raw, as many of us now drink raw water. I am in favor of a regulation requiring all water used in garrison for potable or culinary purposes to be cooked, so that when troops take the field they will continue to use cooked water, as they continue to use cooked beef and bread.

The dangers in water should be impressed upon the recruit, a difficult matter, and the fact that it can be rendered safe by boiling taught him. The question of cold water is of no real importance, as, before the system can use it, it must be heated to the temperature of the blood. The cold in the water affords but momentary gratification and often does damage. I think every soldier should be furnished with tea tablets, one of which would be sufficient to make a canteenful of weak tea. This is sweetened by the saccharin in the tablet, and necessitates the boiling of the water. A practicable coffee tablet has not yet been made. Do not forget the cleaning of the eating utensils, haversack, and canteen.

The importance of adequate and healthful amusement can not be overestimated. The conditions of the recruit's surroundings are so unaccustomed that the whole tendency of early camp life is toward ennui and homesickness, which often results in an absolute breakdown; hence the necessity for occupation and healthful amusement. Music helps, athletic games, and contests of strength and agility should all be encouraged and little time given the men to get grouchy or depressed.

From the barrack room to the skirmish line, every step of the soldier must be watched and directed. He may do great things for his country if he be fit, and may become a useless burden upon it if otherwise. Therefore it behooves the country to see that its soldiers are so developed and matured that they will be fit, and this can be accomplished only by the most intelligent and careful training.

THE DISPOSAL OF WASTES.

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The scope of this article will be confined to a discussion of those methods which have been found most satisfactory for the disposal of wastes in camp, the method of disposal of such material in garrison being highly similar to that practiced in many civilian communities.

The wastes which will be considered here may be classified as follows:

HUMAN.

Alimentary: Solid and liquid.
Lavatory: From the person, from clothing.
Excrementitious: Solid and liquid.
Miscellaneous: Paper and worn clothes.

ANIMAL.

Excrement: Solid, liquid, dead animals.

TERRESTRIAL.

Vegetation.
Inorganic waste: Water.

The method selected for the disposal of wastes in any camp is influenced by a number of conditions which under varying circumstances have different relative values. Some of these are the permanency of the camp, the resources and equipment available, the size of the command, its state of discipline, whether pollution of streams or soil is legally and morally permissible, etc.

It is generally agreed that wastes may be best disposed of by incineration, but this method presents several difficulties. Of these the most important are the time and effort necessary to construct or establish incinerators, the cost of fuel to operate them, and the

difficulty of obtaining this in the field. These difficulties are such that incineration of refuse is rarely feasible except in semipermanent or permanent camps. Where these are established, however, any one of several devices for incinerating alimentary wastes may be utilized. For the communal service of the entire camp the following devices may be mentioned:

1. The large crematory of the "rock-pile" type. This is made by digging a hole 3 feet deep and 15 feet in diameter, flooring to the depth of 1 foot with loose rocks, walling up its sides with loose rubble rock to a height of 4 feet and erecting in its center a cone 6 feet high, also made of loose rocks, so that the structure has the general configuration of a cake tin. The central cone is essential to obtain draft and to retain the heat.

2. Two trenches may be dug which cross each other at the middle at right angles. Each trench is 6 feet long, 1 foot wide, 4 inches deep at its outer ends, and 18 inches deep at its middle point. Pieces of railroad iron are placed across the trenches where they intersect. Wider, deeper trenches may be dug and their floors and sides built up with rocks. Obviously the larger the unit it is to serve, the larger the trench crematory should be and the more elaborate its construction. Solid garbage is dumped on the grate made of railroad iron, while liquids are poured into the ends of the trenches. The efficiency of the device can be much improved, if one uses also a cylinder of sheet iron about 2 feet in diameter placed above the point where the trenches intersect, and if the solid refuse be dumped into this. The cylinder not only retains such material, but tends to confine the heat and to act as a chimney. It may be used without the grates. The rock-lined trenches provided with a grate and cylinder make a most efficient and inexpensive primitive device for communal consumption of refuse.

3. A modification of the foregoing is a simple cylinder made of sheet or corrugated iron. Sheets of either of these materials are wired together, and in the end of the cylinder resting on the ground four holes are cut on opposite sides. The cylinder is about 4 feet high and from 2 to 6 feet in diameter. One 5 feet in diameter and 4 feet high with holes 8 inches square is sufficient for a regiment. Tin cans in the garbage aid the draft in this device. Garbage and manure should be burned alternately and sprinkled with crude oil from time to time. If the device be made in the shape of a truncated cone its draught is improved. A wire frame in which the refuse is dried before it is burned may be fastened to the outside of the cone or cylinder. If the sheet iron is not obtainable, this cylinder or cone may be made of mud, in which case its walls should be at least 6 inches thick. In rainy weather all those devices using a cylinder or a cone should be covered by one or more pieces of sheet iron, and combustion facilitated by crude oil.

4. A fourth device is a grate of iron bars, such as railroad iron, supported on two parallel walls which are made of earth, brick, or stone, and are about 15 inches high and 6 feet long. These walls should be about 4 feet apart. The surface of the ground between these should be ridged so that fuel lying on it may have a fair draft. Garbage is placed on the grate bars. Improvements of this simple device are (1) inclosure of a third side of the fire box, (2) provision of a second grate on which the fuel rests, and (3) the erection of a chimney made of metal, bricks, or mud. Sometimes, instead of building a second grate, the floor of this device is excavated to a depth of 1 foot and filled up with rocks. Liquid garbage is poured over these and solid garbage incinerated on the grate. In rainy weather, especially in the Tropics, all such grates should be covered by an open shed.

5. In the camp at Fort Riley, in 1910, all garbage, both solid and liquid, was hauled up to a central platform and there dumped. This platform sloped slightly from both sides down to a central chute which was protected by a screen of one-fourth-inch iron rods 2 feet long placed 1 inch apart. Liquids ran through the screen into the Kaw River. A lateral chute 18 inches broad led from each side of the platform to an excavation about 6 feet long and 4 feet wide dug in the river bank. The sides of the excavation were bricked up and supported two grates—a lower one 1 foot above the soil on which the fire was built, and another made of railroad iron 1 foot above the first on which the solid garbage was shoveled through the lateral chute leading to it. A chimney 12 feet high was secured to each upper grate. The device was efficient and inexpensive.

The tendency in many camps to-day is to have each company dispose of its own garbage near its kitchen. If this material is hauled to a communal crematory, either in cans or in sanitary carts, some of it is inevitably spilled on the ground and fly breeding may thus be facilitated. Also, if local disposition of garbage is effected, the quantity of liquids used in the kitchen is reduced to a minimum, and the company obtains a valuable object lesson in sanitation.

The best type of company crematory yet developed has a fire bed of rock 1 foot deep (for the heat from the fire does not penetrate beyond that depth), 60 inches long, and 30 inches wide. It is surrounded on three sides by a rock wall 1 foot high. The closing in of the third side increases the evaporating capacity of the incinerator and reduces the amount of fuel required. Crematories built of large rocks over permeable soil are the most efficient ones.

About one-sixth cord of wood per day per company is more than sufficient for the destruction of all refuse from the kitchen of any company if ordinary care be given this type of crematory. About 100 gallons of liquid and 23 cubic feet of solid garbage can thus be disposed of daily. Liquids are evaporated by being poured slowly along the vertical walls of the incinerator, not upon the fire bed, and the solid garbage is placed on top of the fuel. Some experience is required before troops can successfully operate these kitchen incinerators.

In some camps liquid garbage is strained off through a burlap-bottomed box and poured into a hole some 4 feet deep and 4 feet in diameter filled with broken rock, while solids are burned in the kitchen fire. This method of disposal is feasible only in porous soils and in dry weather, and is not free from obvious objections. The ingress of flies into these pits is prevented, to a degree at least, by brushing their surface and vicinity with oil.

In camps occupied for only a few hours or days the kitchen refuse from each company is usually buried in a shallow pit which is filled in just before the troops leave camp, or solids are burned in the kitchen fire and liquids are thrown into a shallow pit. The method is not ideal, but in practice is found to give reasonably

satisfactory results if the camp site is not occupied again for several months.

In some camps solid garbage is sold to farmers and hauled to a distance of not less than half a mile (the alleged maximum distance that a fly will travel from its breeding place), and there used as a fertilizer. Liquid garbage may also be removed in proper receptacles if lime be added to it in the proportion of about 6 per cent. In this proportion it is a disinfectant and also discourages fly breeding. Lime, it will be remembered, is a valuable fertilizer. This removal and usage of refuse which has been rendered innocuous is, from an economic standpoint, preferable to its destruction.

Water from lavatories, laundries, and bath houses should be removed by pipes, tiled drains, or ditches. These methods of removal are desirable in the order named. Ditches may be filled with loose rocks and then covered with earth or sod, or they may be lined with concrete. Ditches made of concrete reenforced with chicken wire cost about 10 cents per running foot, are quite permanent, and, on a hilly site, are very satisfactory for drainage of waste water. Sometimes small tiled drains are used to fill a portion of a ditch and are covered with broken rocks. They are less expensive than full tiling would be and quite as efficient.

The method of disposal of human excrement is also determined according to circumstances. Rapidly moving troops as a rule dig shallow trenches and fill them in before resuming the march. On the Continent troops making but one-night camps as a rule dig trenches which are from 18 inches to 2 feet deep and as wide as a spade. Men squat astride these trenches when defecating. In more permanent camps trench latrines are dug 3 feet deep if the camp is to be occupied two days; 4 feet if three days, etc. If the camp is to be occupied more than a week the pit should be dug from 6 to 8 feet deep, be 3 feet wide at the top and 2 at the bottom. It should be long enough to accommodate 8 per cent of the command, allowing 2 feet to each man. This will allow sufficient room for the ends to be used for urinals. Each company or other organization should dig its own latrine.

In rocky or sandy soils pits can not be dug as indicated above. In the former they must be dug as well as circumstances permit, and the results are often unsatisfactory. In the latter the pits must either be quite shallow or, if possible, shored up with lumber.

Where a camp is to last more than six days (the minimum period during which flies may breed) the latrines should be covered by fly-proof boxes. One of these, the Havard latrine box,[1] is knock-down and transportable, with interchangeable parts.

Lyster has recommended that in semipermanent camps where the boxed latrines are employed the edges of the pit be protected by a framework and that the boxes used be smaller than the Havard latrine box and made of tongue-and-groove lumber. If need be, several boxes may be used over one long latrine pit, as the large boxes are unwieldy.

A serviceable box is one 8 feet long, 18 inches wide at the top, 30 inches wide at the bottom, 16½ inches high in front, and 15 inches high in the back, ventilated by screened openings 8 inches square in each end. Four holes are cut in the top and covered by lids which can not be raised to a right angle because of blocks nailed back of them. There should be a sloping shelf of tin or wood nailed inside the box to deflect the stream of urine into the pit. Galvanized-iron troughs with outlets into the pit should also be provided.

Tubs, cans, boxes, or troughs, one for each company street, must be provided for night urinals. They should be emptied into the pits, burned out daily with crude oil, and, when the fire is extinguished, coated with oil.

Pits may be burned out at 9 a. m. daily with 1 gallon of crude oil and 20 pounds of straw or hay. When thus burned out, pits 6 feet deep and 16 feet long last a company two or three months. When filled to within 2 feet of the top, they should be thoroughly burned out, limed, and filled in. If a larger quantity of oil were used, and no hay or straw, pits would fill less rapidly, especially in rainy weather. Latrine boxes should be whitewashed inside and out. Lime in the proportion of about 1 barrel a day to a regiment of 1,000 men should be used in the camp latrines, even though they be burned out daily. Its use prevents odors. Latrine shelters for summer camps should be constructed without covering, as the disinfecting action of sunlight upon the seats is of greater importance than the increased comfort furnished by roofing the shelter. Shelters should be whitewashed inside and out. It has been noted that such latrines are free from flies.

Sometimes oil is not available for burning out the pits, or, the pits being shored up, such burning out is not feasible. In these cases one-half pound of dry earth per capita per day should be thrown into the pit by each person using it, or the pit should be limed daily, using one part of milk of lime to one of dejecta, and doubling this quantity on alternate days, or both earth and lime may be used. Dry earth is a more valuable disinfectant for this purpose than ashes, or many disinfectants advertised for use under these circumstances. The lime used must be fresh. Air-slaked lime is worthless.

Raw troops do not appreciate the necessity for making their dejecta innocuous. For this reason, in some marching commands which dig shallow pits and cover their dejecta individually, it is the

practice to place a man in charge of the company latrine until he apprehends some person who fails to cover his deposit, and to require this delinquent to remain in charge until he in turn apprehends some other person equally negligent. In fixed camps one man is usually detailed permanently to care for the company latrine. Frequent inspections in fixed camps are necessary to see that lids of latrine boxes are kept closed, that the boxes are fly proof, and that pits are burned or limed properly.

Straub reports that a four months' trial near San Antonio, Tex., of the latrine-pit system protected by boxed coverings and burned out daily with crude oil and straw has demonstrated its value. Under these conditions the latrines were odorless and free from flies, and the amount of work and the cost of maintaining them were very much less than that of installing and caring for more elaborate devices.

The usage of even the best type of pits, however, and the care of them as indicated above, are, under certain circumstances, yet regarded with much distrust. Especially is this the case if the camp site is contracted, is used frequently, is on wet soil, or if the level of the ground water is high. Below a level of 4 feet the nitrifying bacteria are few, and if pits are dug beyond that depth in ground that has formerly been occupied old pits, not disinfected, may be reopened.

The life of microorganisms in the upper layer of the soil depends almost entirely upon the amount of moisture present. The comma spirochætæ will live after 174 days in earth containing 7.1 per cent of moisture, but in dry soil will live only one or two days. The *Bacillus typhosus* will grow upward through 18 inches of moist earth, and has been found after 11 months in the upper layers of infected soil.

Dust blown from dried feces, or from latrines not properly disinfected or filled in, is believed to have been a source of infection during the war in South Africa, and probably is a perennial source of infection in many places in the Orient.

Many attempts have been made to replace the latrines by some other efficient means of disposal of dejecta. The ideal method, theoretically, is by incineration, and several types of incinerators have been developed. Most of the objections to the latrine have now been obviated, however, by the usage of fly-proof seats and the disinfection of the pits by fire (thus making the pit itself an incinerator), or by the liberal use of quicklime. As yet, no mechanical incinerator has been devised which meets all practical objections. As a rule, such devices are relatively expensive, are too heavy for transport with moving troops, and lack durability. The time required for their installation, the cost of fuel for their operation, and the necessity of trained employees to care for them are other objections.

The incinerators most commonly employed in the American service are the McCall, the Conley, and the United States Army Quartermaster types. Of these, the McCall is the most efficient, but, with certain minor changes, the Quartermaster type could be made equally so. As constructed at present the pans for charcoal and feces, in the last-mentioned type, are made of such light material that they warp, and the arms supporting the feces pan are too short. The Grenadier type of incinerator used in the British service in India is excellent. P. S. Selean [2] has given us a description of several excellent incinerators.

The cost per seat for installing and operating water-closets is generally less than that for incinerators, even in semipermanent camps.

A simple system is the following, installed for the First and Third Regiments of the First Separate Brigade at Galveston in 1911.

For each battalion of 400 men there was built one zinc-lined trough, 42 feet long, 22 inches wide at the top, 14 inches wide at the bottom, and 18 inches deep. The zinc lining was made of 48-inch sheets, soldered together, and nailed to supports so shaped that a cross section of the trough was parabolic. This trough sloped down from each end so that it was 6 inches higher at the ends than in the middle. From the middle point there projected downward a zinc-lined chute, 3 feet long and 4 inches in diameter. This chute was ordinarily closed by a plunger which was padlocked to a stout crosspiece. Into the cover of each trough were cut 18 seats such as are used in water-closet apertures, and two openings, each 30 inches long, to be used as urinals. One of these apertures was at each end of the trough, and they were so cut that they came quite to its edge. These seats and apertures were fitted with covers which closed automatically.

The cover of the trough in which the seats and urinal apertures were cut was divided into hinged sections, so that it could be raised, and the trough exposed through its entire length.

These troughs were placed in the rear of the battalions, over manholes, with their chutes projecting downward into a sewer. Water was piped to each trough and let in through a faucet which could be operated only by a wrench. Twice daily the plunger was raised, the trough emptied and refilled, and 1 quart of crude oil poured in. The manhole, except where the chute passed through, was kept closed by a wooden cover.

Each trough cost $20, all labor except the plumbing being performed by enlisted men. The troughs were constructed and installed in three days. The sewer was already constructed when adapted to this use. The system proved entirely satisfactory; it was inexpensive, adequate, easily operated, odorless, and fly proof.

Reed troughs are objectionable on account of the difficulty in disposing of the excreta, the weight of the wagons, the cost of upkeep, and the frequent unserviceability of pumps. These troughs and the method of using them are described by Havard.[3] They are by no means obsolete, however, as some suppose, for in semipermanent camps where pits can not be dug properly, and in sites where the ground water is high, they often give better service than do either incinerators or boxed latrines. They are especially serviceable for raw troops which have yet to learn how pits must be constructed and cared for.

Where the construction of latrines is not feasible, and neither Reed troughs, incinerators, nor water-carriage systems are available, the best device is a modification of the latrine box. It should be so constructed that pans, buckets, or tubs may be used to receive dejecta and removed through the back of the box, which is ordinarily closed by a fly-proof falling door. Dry earth or milk of lime, or both, should be used on the dejecta, and the tubs or other receptacles emptied and cleansed daily. Where incineration is not possible, this refuse should be removed to a point at least half a mile from camp. In some cases it can be incinerated, or buried, at a central point. Crematories, when used for the destruction of human dejecta, require much oil and other fuel.

Animal refuse is destroyed either by burning with oil on the picket line, or, if this proves offensive, by removing it to a communal point and there burning it in some such device as that mentioned for the consumption of garbage. Sometimes it is removed to be used as manure. Even if the refuse be removed, the picket lines should be burned over weekly with straw and oil, in order to destroy larvæ developing in the soil.

Liquid animal refuse should be removed by ditches. These should be limed weekly.

Dead animals should be burned in a crematory. If this is not feasible they should be buried in pits 8 feet deep. Pasteur has shown that earthworms will bring anthrax spores to the surface from a depth of 5 feet and probably farther. For this reason the animal's carcass should be embalmed, if possible, before interment, e. g., by introducing formalin or similar disinfectant into the carotid artery. Quicklime should be used in the pit.

Miscellaneous refuse about a camp should be destroyed, or at least disinfected, by passing through a company or communal crematory.

Decaying vegetation should be burned in one of the devices mentioned for the destruction of garbage.

Water should be removed by ditches or drains. If the camp be on a precipitous site, ditches should be zigzag, so that erosion by a

too rapid current may be avoided. In permanent camp sites erosion of ditches and growth of vegetation in them can be retarded by burning them out each spring with crude oil.

[1] Harvard: Military Hygiene.
[2] Journal of the Royal Army Medical Corps.
[3] Harvard: Military Hygiene.

DISCUSSION.

MAJ. B. K. ASHFORD, United States Army: I want to call attention to the failure of odorless excavators to evacuate contents of cesspools in Porto Rico during the cleaning up of small towns. I believe it of importance to recognize the inadequacy of the odorless excavators for this purpose, as, in active service, sanitary administration of towns under military control may fall to medical officers of the army. The difficulty in working the excavators in this manner is due to the solidity of the sediment at bottom of cesspool.

THE DISPOSAL OF HUMAN EXCRETA IN MILITARY CAMPS.

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The problem set forth in the title of this paper is one of the most important that the military sanitarian is called upon to solve. His solution can not always be satisfactory, and in the future, as in the past, trouble and disaster will follow failure. However, the number of failures will probably never again be so great as in past times; and this for several reasons, among which we may name the following as most important:

1. The more general diffusion of knowledge of sanitation, which has now become so great as to reach even to a large portion of the enlisted personnel.

2. The more general recognition of the importance and necessity of the work of the trained sanitarian, with resulting increase in the power of medical officers to remedy defects.

3. Increased knowledge by medical men of epidemiology and general sanitation, which enables them to perform their duties more intelligently and more effectively.

The dangers to be feared from improper disposal of human waste are now so well known as not to require enumeration. It is also known that they include the greatest dangers which threaten armies in camps, and that typhoid, dysentery, cholera, and their kindred come directly or indirectly from the ingestion of a neighbor's dung. So it is worth while, in considering this subject, to discuss the methods by which such ingestion is brought about. We may say that, for

practical purposes, and in the large majority of instances, it occurs because there is a failure to attain one or more of the following three objects:

1. Prevention of contamination of persons and grounds by excreta.
2. Prevention of contamination of water by excreta.
3. Prevention of contamination of flies by excreta.

Success in these should go far toward assuring freedom from enteric infections. In order to attain such success, it is necessary, in addition to the measures of waste disposal to be enumerated later, (*a*) that personal education and cleanliness shall so extend into the enlisted ranks as to lead to unfailing hand washing after visits to latrines and before handling food, to cleanliness of clothing and personal equipment, and to avoidance of carelessness in urination and defecation; (*b*) that all possible precautions be taken for the protection or purification of the water supply, especially that used for drinking; (*c*) that flies be kept from breeding in or about camp, and be destroyed when possible; and (*d*) the prevention of the importation or use of infected food. Without these precautions enteric infections may occur, even though the excreta be disposed of in the best way possible under the circumstances.

The available methods for disposal of excreta in camps are:

1. By incineration.
2. By water carriage.
3. By land carriage: (*a*) The pail or box system, (*b*) the dry-earth closet system, (*c*) the latrine cart system, (*d*) the Reed trough system.
4. By disposal in the soil.
5. By combinations of these methods.

Considering these in turn, we may say of incineration that it possesses the advantage of safe and sanitary disposal, with sterilization, it does not attract or breed flies, and does not contaminate the soil or the water supply. On the other hand, the first cost of the incinerators is large, the cost of upkeep and fuel excessive when the troops are moved, carelessness in handling leads to the development of bad odors, and the equipment necessary constitutes such a mass of impedimenta as to make its removal ordinarily impracticable. The method may therefore be considered in most instances an unattainable ideal.

Water carriage is, in some exceptional cases, an excellent method of disposal. The conditions under which this is true, however, are relatively few, and will usually be one of the following:

1. The camp will be known to be permanent or semipermanent in character, and will be situated on or close to tidal water or a stream not used for drinking purposes, that will remove the excreta promptly or at short intervals.

2. It may be of a very temporary character, and yet so situated with regard to tidal or running water as to make their utilization for the purpose both simple and inexpensive; for instance, the building of seats out over the water.

In the former case the installation may be anything from a complete sewerage and water-closet system to one as simple as that mentioned in the latter instance.

Of intermediate arrangements, a good one is the use of troughs of the Reed type connected at their lower ends with drains of glazed tile that are laid with a good fall. The outlet of the trough should be closed by a hollow cylinder open at the level at which it is desired that the water should stand, say, 12 inches from the bottom. Through this the accumulating fluid finds exit, while at intervals of once a day or oftener the whole trough is flushed by simple removal of the cylinder, which allows it to empty.

Another plan that has been found to afford a certain amount of satisfaction in a permanent camp emptying its waste into a small stream includes large closed boxes or tanks made of concrete (wood might be used) into or through which the sewage flows and in which enough sedimentation and disintegration occur to make the outflow a pale opalescent fluid almost free from odor and from easily visible particles. It is not contended or thought that the sewage is thus purified, but the plan has two distinct advantages in that it almost does away with bad odor and it offers no encouragement for the breeding of flies, while purification by chloride of lime is a possibility. Despite its advantages, though, water carriage of excreta is rarely applicable to camps, especially in campaign, and we pass to the more common method of disposal by carriage on land.

These methods—the pail system, the dry-earth closet, carts, and Reed troughs—all have the common fault that, while they provide for the reception of the excreta as passed from the man, the manner of their ultimate disposition remains to be decided on the spot and a satisfactory final disposition is always difficult and at times impossible. Among the expedients resorted to have been burial, burning, dumping at a distance from camp, dumping into water, and disposal into large pits. All are imperfect, laborious, expensive, and unsatisfactory. They are apt to constitute nuisances, to attract and breed flies, to pollute water supplies, and in many instances to pollute the surface of the ground. Within the writer's experience the most satisfactory of these methods has been the disposition of the contents of Reed troughs into large pits, where the surface of the refuse was kept covered with a layer of crude petroleum. This resulted in absence of odor and of flies, but the labor involved in handling excreta from troughs to pits was considerable, that ex-

pended in digging pits more, and accidents occasionally happened which resulted in soiling the ground of the camp.

Such accidents are liable to occur with any system requiring the handling or carrying of dejecta through the camp. In addition, each method has inherent objectionable features. Pails and boxes require much labor to clean them, and much supervision is necessary to see that the cleaning is thorough and that they are kept covered when not in use, otherwise bad odor and flies abound. The use of dry-earth closets is often impossible because of lack of dry earth, the impracticability of separating feces and urine, the consequent mass of feces and mud to be handled, and the impracticability of keeping flies away from such a mixture. They, like pails and boxes, are not easily movable with the troops. Latrine carts are highly expensive because of the transportation and labor they monopolize. Reed troughs also demand large expenditure in money, labor, and transportation, and, in addition, if used with lime, in accordance with the War Department order prescribing their use, they neither sufficiently repel flies nor do away with bad odor. It may be said, though, that both of these objections can be met by the use of crude petroleum instead of lime. The objections above set forth will in most camps, especially of mobile troops, be sufficient to prevent the use of any method of disposal calling for transportation of excreta by land, and we are driven back to the consideration of those most ancient of methods that have at other times seemed so faulty that all of the methods we have been considering were evolved as substitutes for or improvements upon them, namely, disposal on or in the soil.

Of these methods there are three principal ones:

1. Disposal on the surface of the ground, with little or no covering.
2. Shallow burial.
3. Deep burial.

The first method need only be mentioned for condemnation, as it leads to contamination of soil, persons, water, and flies.[1]

The second method seems to have had a considerable use in the British and Indian services, but a limited practical experience with it and much thought concerning it have failed to convince the writer that it has great value, if any, in camps of more than a few days' duration. Its most obvious faults are that flies can breed in feces exposed to them and then buried to a depth of only 6 to 10 inches; that a relatively large amount of ground is necessary; that pollution of the feet is more probable; that soiled paper is apt to be blown about camp; that a relatively light rain, especially in the Tropics, will flood such shallow pits and diffuse their contents. Therefore the use of the shallow-trench system should be limited to short camps and dry and quiet weather, except in those unusual places where rock or

"hardpan" comes so close to the surface of the ground that it is impossible with ordinary tools to dig down more than a very short distance. Under such conditions the system is thought better than most of those involving carriage of excreta through camp. When used, the system calls for the constant presence of a sufficient guard to see that each man promptly covers his own dejecta; that toilet paper is properly inclosed, weighted, or (after use) covered; and to attend to the final filling, packing, and turfing of each trench at the proper time. Judging from its efficiency about other forms of latrine, it is thought that the use of crude petroleum about shallow trenches would lessen or inhibit the production of both odor and flies. Probably painting the sides of the trench and sprinkling its contents with this substance would be helpful.

There remains for consideration, then, the deep-trench latrine, which has so much of history to condemn it, including the tremendous enteric morbidity of our own troops during 1898, and which has been eloquently and truthfully denounced as a contaminator of persons, soil, and water, a breeder of flies and of smells, and a constant source of supply where flies might and did load up with typhoid bacilli before visiting the kitchen and mess tents. Nothing too severe has been said of this system as it has often been used, but more recently, since the importance of preventing pollution of the surface of the ground (and consequently of persons) and of preventing access of flies to the feces has been appreciated, and since actual and extensive practice has demonstrated the great value of such precautions, that is no longer true. Practical experience shows definitely that the only danger to be apprehended from a proper use of deep-trench latrines is the pollution of the ground water; and as purification of the drinking-water supply or the introduction of a safe supply from outside sources is feasible and practically always desirable, even when incineration of excrement is possible, and as such measures are less expensive and more easily practicable than the employment and movement of the paraphernalia of the Reed trough and incinerator systems and more readily fit into military plans, the deep-trench system is destined to have still further use. It must be constantly borne in mind, though, that such use must be *proper*, and that a necessary corollary is the use of a pure or purified drinking water. If a pure water supply can be piped throughout the camp, that is desirable. If the water used is ground water (other than artesian) obtained at the camp site, then the greatest care should be exercised to see that it is properly purified before use. Whether that purification should be effected by heat, filtration, chlorine, or other treatment it is not the province of this paper to discuss.

We may, though, consider what constitutes proper care and management of the latrine. First of all, it should be dug to a suitable

depth, usually 6 feet or more, and protected from rain, washings, and caving. Then, and this marks the first great improvement, it should be covered with boards, a seat, and banked earth, if necessary, to close cracks and crevices, in such a way as to make it fly proof and dark. Separate urinals of tarred-paper funnels, opening into it through small angular tunnels, should be placed at each end. They may be made impassable to flies by stuffing them lightly, toward the bottom, with grass or straw, although painting them inside each day with crude petroleum suffices for this and prevents odors.

A full description of an excellent cover and seat is given by Havard,[2] and this, which is called the Havard box seat, may be taken as a model. That box, however, is made of lumber and weighs 175 pounds, so that its transportation might at times be difficult. Maj. Dukes, of the California Militia, has designed and had made a similar box of pressed steel, which knocks down and packs in a very small compass, weighs considerably less, and is therefore more easily transported. Unless bought in large quantities, however, the box would cost considerably more than one of lumber.

On the other hand, various improvisations can be made that will require much less lumber, if tarred building paper, burlap, or cheap muslin be substituted for it on the ends and sides of the box and for seat covers. By keeping in mind the requirements of making the pit dark and fly proof, the resourceful medical officer can practically always devise a satisfactory cover.

As to the subsequent care of the pits, it is thought that the use of crude petroleum has advantages as a pit dressing that put it in a class by itself. It keeps down bad odors in a remarkable manner, is very repellant to flies, does away with the use of lime or earth in pits, and prolongs their utility indefinitely in absorbent soils. It may be easily handled in such a way that the handler does not risk contamination with fecal matter, it is relatively small in bulk, and is easily transported; it seems to possess valuable powers as a disinfectant. It can also be turned to many other useful purposes in camps, such as the prevention of flies about kitchens, the destruction of mosquito larvæ, or, in case of emergency, in incinerators or on manure piles. It should be used about latrines to paint the insides of urinal funnels and to sprinkle the surface of the pit contents each day. The amount necessary for these purposes is small. Other methods of caring for pits are also much used, but are not so satisfactory. Earth or lime are at times used to cover each day's dejecta. The objections to these are that they do not so well keep down odors or prevent fly breeding, and they rapidly fill the pit, lessen its period of usefulness, and necessitate extra labor to dig others.

The burning out of pits has also been used as a routine, and has usually given satisfaction. At best, though, the results are not bet-

ter than those obtained in the manner set forth above. The burning is apt to give rise to odors, it is impossible to so incinerate or disinfect the feces as to prevent the possible and probable pollution of the local ground water, the fuel costs more than the oil used for sprinkling and is harder to transport, and the procedure entails a considerable amount of disagreeable labor. As conclusions based on the above considerations, which in turn are based on a considerable practical experience, it may be said that—

1. Convenience and military considerations will probably continue to make deposit in the soil the common disposition of the human waste in military camps.

2. The deep-trench latrine, properly used and cared for, usually offers the most convenient, safe, and practicable method of accomplishing this.

3. Proper use of such latrines means that they should not pollute persons, the surface of the ground, or flies.

4. Therefore, they should be made fly proof by the Havard box seat or its equivalent.

5. Crude petroleum as a dressing for pits and urinals is of great value, and should always be used if possible.

6. The proper care of latrines can not of itself be expected to guarantee freedom from enteric infection, and other measures must be used, especially purification of drinking water, avoidance of infected food supplies, and the practice of personal cleanliness and hygiene by all in camp.

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[1] However, the writer recalls one brigade camp in which such disposition of urine was thought justifiable. The camp was in a region where "hardpan," a formation as hard as many sandstones, was either at or within a foot or two of the surface. The digging of deep trenches was impossible, as picks and crows were soon blunted and made unusable, and when a trench was cut out to a depth of 2½ feet the soil was so nonabsorbent that urine quickly filled it. In the neighborhood were some patches where the overlying soil was deep enough to permit of plowing, and this had been done. A constant wind was blowing, and it was found that urine and strained kitchen water, when thrown on this plowed ground to the leeward of camp, was absorbed by the loose soil and held until wind and sun completed its speedy evaporation. Such things have to be done at times in military service, and the military surgeon's usefulness then depends on his ability to choose the lesser of evils and to make the best of bad conditions.

[2] Havard: Military Hygiene, p. 385.

TUESDAY AFTERNOON, SEPTEMBER 24, 1912.

ALIMENTATION EN EAU DE BOISSON DES TROUPES EN CAMPAGNE.

Médecin Inspecteur Général Février, Directeur du Service de Santé du Gouvernement Militaire de Paris, France.

Dans les congrès internationaux d'Hygiène de Berlin, en 1907, de Médecine de Budapest, en 1909, des rapports très complets ont été consacrés à la question de l'alimentation en eau du soldat en campagne (Médecin-Major de première classe Rouget, Berlin 1907; Médecin-Major Erhard Glaser, Budapest 1909).

Dans ces rapports ont été exposés dans tous leurs détails les procédés susceptibles d'être utilisés pour protéger les troupes contre les épidémies muertrières de fièvre typhoïde, de dysenterie, de choléra. Toute la bibliographie de cette importante question a été reproduite dans ces mémoires où leurs auteurs ont suivi pas à pas les améliorations successives qui avaient été apportées aux méthodes mécaniques, physiques ou chimiques d'épuration des eaux.

Je n'entreprendrai pas à nouveau cette description qui exposerait à des redites, et qui aurait le grave inconvénient de n'apporter aucun document nouveau, les méthodes d'épuration n'ayant pas varié depuis l'époque récente de la publication de ces rapports.

Il m'apparait plus digne d'intérêt de vous présenter une étude d'ensemble de cette question. Les observations faites par le service de santé de notre armée, au cours des opérations des troupes débarquées au Maroc, fournissent à cet effet les enseignements les plus précieux.

Au Maroc sévissent avec une égale intensité et une redoutable gravité la fièvre typhoïde et les dysenteries bacillaire ou amibienne. Par contre aucune atteinte de choléra n'y a été observée.

On peut dire sans exagération que tous les procédés d'épuration ont été expérimentés et adaptés aux situations spéciales des troupes.

Il y a lieu de considérer en effet, qu'en campagne, le problème de la fourniture au soldat d'une eau de boisson hygièniquement pure, c'est-à-dire exempte de germes nocifs, ne comporte pas une solution polyvalente.

Les méthodes varient avec les situations diverses de la troupe, elles ne sont pas les mêmes en station ou en colonne; la collectivité n'utilise pas les mêmes méthodes que le soldat isolé et éloigné de son unité.

Ce sont ces différentes côtés du problème que nous allons examiner en passant successivement en revue les procédés qui paraissent le mieux adaptés aux circonstances variables de la vie en campagne.

ALIMENTATION EN EAU D'UNE TROUPE EN STATION.

C'est au service de santé qu'est dévolu le rôle de procéder à une enquête sur la valeur hygiénique de l'eau destinée à une troupe qui va stationner.

Il doit se renseigner sur l'état sanitaire de la population, faire une étude rapide des lieux, pour rechercher les causes de pollution de la nappe souterraine et procéder au moins d'une façon sommaire à une expertise chimique.

Cette analyse exige l'existence d'un matériel simple, dont le maniement soit facile et qui fournisse des résultats d'une rigueur suffisante.

La plupart des armées disposent de ce matériel; celui de l'Armée française est renfermé dans une petite caisse susceptible d'être contenue dans le sac d'infirmier.

Elle renferme les réactifs et les produits nécessaires à la détermination des caractères organoleptiques, à la recherche des nitrites, de l'ammoniaque, à la détermination de l'indice de souillure.

Au moyen de solutions titrées renfermées dans des ampoules scellées, de comprimés destinés à servir seulement de réactifs indicateurs, il est possible en quelques minutes de déterminer avec une précision très satisfaisante la valeur hygiénique d'une eau.

Ainsi exécutée, l'expertise renseigne sur le degré de potabilité de l'eau.

Trois cas peuvent se présenter:

L'eau est naturellement pure, elle peut être consommée sans précaution préalable.

Elle est suspecte ou franchement mauvaise. S'il est possible de s'approvisionner ailleurs dans des conditions hygiéniques meilleures, on doit en interdire l'usage; sinon il est indispensable d'épurer l'eau avant consommation.

ÉPURATION.

En station, tous les procédés connus d'épuration et particulièrement les procédés physiques et chimiques peuvent être employés avec avantage. Seuls les procédés mécaniques artificiels ne sont pas à envisager. Lorsque les bougies Chamberland ou Berkefeld sont neuves et que l'eau est limpide, les filtres fonctionnent d'une manière satisfaisante; mais leur débit ne tarde pas à diminuer et les difficultés de leur régénération obligent de suspendre leur emploi.

Par contre, l'utilisation de filtres à sable non submergé du système Miquel et Mouchet donnent des résultats les plus satisfaisants. Leur construction est rapide, leur installation et leur surveillance sont faciles, et je leur réserverai une mention spéciale, car ils sont appelés à rendre les plus grands services aux troupes dans les stationnements de quelque durée.

Le filtre à sable de MM. Miquel et Mouchet est un appareil qui épure les eaux par le passage à travers une couche épaisse de sable fin, l'eau étant amenée à la surface de ce sable par un arrosage superficiel convenablement réglé.

Les appareils qui le constituent comprennent: (a) Un réservoir destiné à recevoir les matériaux de filtration; (b) un tube d'arrosage; (c) un réservoir d'alimentation; (d) un filtre dégrossisseur s'il y a lieu, c'est-à-dire quand les eaux à épurer sont troubles et chargées; (e) un réservoir à eau filtrée.

a. Les matériaux de drainage et de soutien comprennent des rangées de briques séparées entre elles par un intervalle de 4 à 5 centimètres. Au-dessus de cette première couche est disposée une seconde couche de briques perpendiculairement placées aux piles sous-jacentes et distantes de 1 à 2 centimètres pour éviter que le gros gravier ne s'accumule dans le bas du réservoir. Au-dessus de ces deux rangées de briques sont étagés successivement des lits de gravier et de sable de plus en plus fins disposés de la façon suivante:

D'abord un lit de 5 centimètres de gros graviers dont le diamètre varie entre 2 et 4 centimètres.

Au-dessus de celui-ci se trouve une couche de gravillons d'un diamètre de 5 à 10 millimètres sur une hauteur de 5 centimètres.

Enfin, au-dessus de la couche de gravillons est placée une troisième couche de gros sable de 3 millimètres de diamètre et d'une hauteur de 5 centimètres.

Sur ce drainage on place sur une hauteur de 1 m. 20 une couche de sable fin, homogène, bien lavée, de 1 millimètre de diamètre.

Un filtre ainsi constitué assure d'une manière certaine l'épuration d'une tranche d'eau journalière de 2 à 3 mètres cubes par mètre carré de surface et par 24 heures.

L'eau est distribuée sur le sable par un sprinkler percé de petits orifices à raison de 10 à 12 par mètre carré.

b, *c*. Le tube d'arrosage est alimenté par un bassin à niveau constant. L'orifice qui laisse échapper l'eau de ce réservoir d'alimentation possède un robinet d'écoulement muni d'un diaphragme limitant l'écoulement de l'eau à une tranche de 2 à 3 mètres cubes par 24 heures et par mètre carré.

La superficie du filtre ne doit, en aucun cas, être abaissée au-dessous de un demi-mètre carré; l'expérience a démontré qu'au-dessous de cette limite, les résultats de l'épuration sont médiocres. Le filtre doit être placé, soit dans l'obscurité, soit à la lumière diffuse. Il faut éviter que les rayons solaires ne tombent directement à la surface du sable, ce qui aurait pour inconvénient de favoriser le développement d'algues et d'amener rapidement l'imperméabilisation de sa surface. Le filtre doit être également mis à l'abri de la gelée. Suivant la nature du sable, les premières eaux filtrées peuvent être

louches et colorées, mais après un fonctionnement d'une durée de huit jours, l'eau devient claire et limpide quoique encore chargée d'un certain nombre de bactéries. Leur nombre diminue rapidement les jours suivants au fur et à mesure que s'opère le lavage des matériaux dont le filtre est constitué.

On peut considérer ce lavage comme suffisamment prolongé après une période de trois semaines. Un filtre lavé l'est pour toujours et l'on ne doit plus y toucher.

Ainsi préparé il peut fonctionner très longtemps. Toutefois, si l'eau est chargée d'une certaine quantité d'argile, la partie superficielle du sable s'imperméabilise et des flaques d'eau se forment à sa surface. Cette circonstance ne menace pas le bon fonctionnement de l'appareil, mais il y a lieu d'y remédier; il suffit d'enlever une couche de sable de 10 centimètres de hauteur, procéder à son lavage, le tamiser et le replacer sur le filtre.

Il importe de savoir que dans les premiers jours de fonctionnement du filtre, l'eau filtrée contient plus de germes que l'eau affluente. Peu à peu leur nombre diminue d'autant plus rapidement que le sable est mieux lavé et privé de substances organiques. Les recherches ont montré que les bactéries trouvées dans l'eau épurée proviennent uniquement des matériaux de soutien et de drainage du filtre. Ce sont des bactéries banales vivant à sa surface et susceptibles de se multiplier, mais qui disparaissent définitivement lorsque le filtre est en marche depuis trois semaines. (Voir ci-dessous un schéma du filtre à sable non submergé.)

ÉPURATION PHYSIQUE.

De tous les agents physiques susceptibles de réaliser l'épuration de l'eau de boisson, le plus employé dans les armées en campagnes est, sans contredit, la chaleur avec ou sans pression.

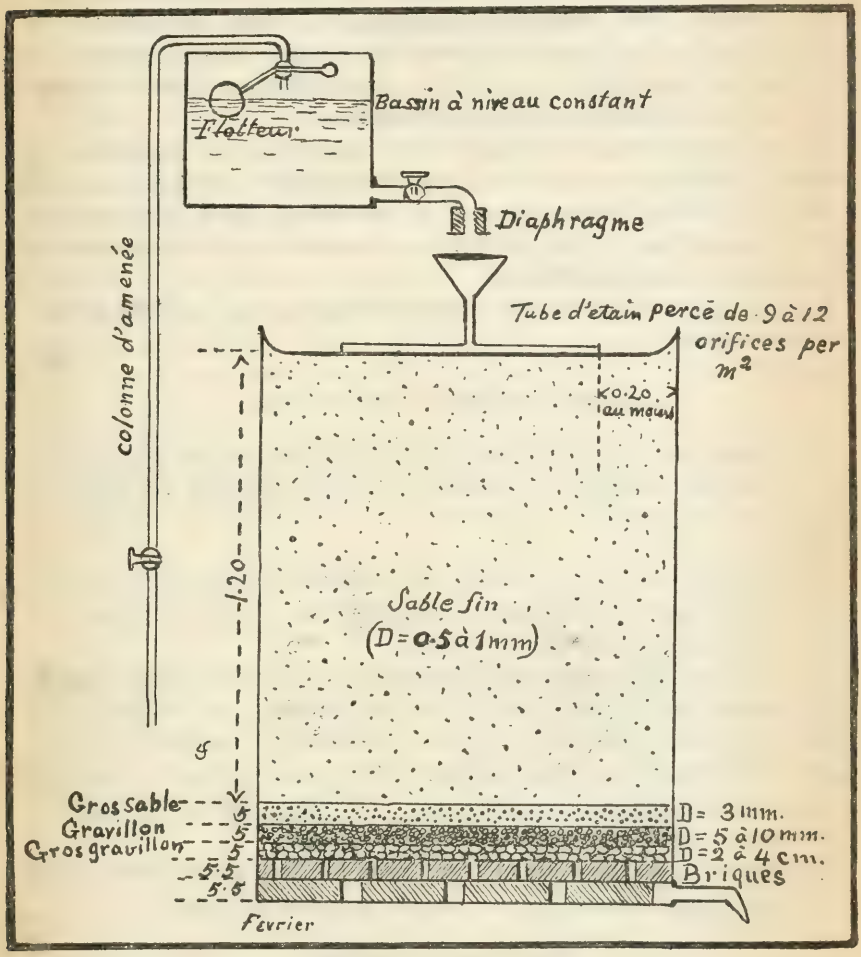
Les stérilisateurs d'eau par la chaleur sous pression ont réalisé un notable progrès.

Ils conservent à l'eau toutes qualités organoleptiques, la stérilisation est absolue et, grâce au dispositif des échangeurs, on réalise une économie de temps et de combustible. L'eau stérilisée sort de l'appareil à une température voisine de celle qu'elle avait à l'entrée (en moyenne 3 à 4 degrés en plus); elle est donc immédiatement potable.

Le modèle des appareils varie avec les constructeurs (appareil Vaillard-Desmaroux, appareil Maiche, etc.); le débit peut aller de 15 litres à 1,000 litres à l'heure, le fonctionnement peut être continu ou intermittent.

Mais la régularité du fonctionnement de ces appareils dépend de conditions qu'il importe de ne pas perdre de vue sous peine de mé-

comptes graves. La pression de l'eau qui alimente le stérilisateur doit être au moins égale à 12 mètres et ne pas dépasser 20 mètres, afin d'empêcher la vaporisation de l'eau sous l'action de la chaleur et de pouvoir, le cas échéant, contrebalancer la tension de la vapeur. De plus, cette pression doit être aussi constante que possible, car il importe d'éviter des coups de pression, très préjudiciables à l'in-



tégrité des organes de l'appareil. Un filtre dégrossisseur est indispensable toutes les fois que l'eau est sujette à se troubler et à devenir limoneuse.

Lorsque la pression est excessive, un détendeur devient nécessaire en amont du stérilisateur. Si au contraire l'eau doit être puisée en rase campagne, dans une rivière ou un puits, il est nécessaire d'adjoindre un moteur-pompe susceptible de fournir la pression nécessaire.

En pratique les stérilisateurs à échangeurs par la chaleur sous pression sont susceptibles de fournir d'excellents résultats en campagne pour des troupes en station, mais leur conduite est délicate et ne peut être confiée qu'à des mécaniciens expérimentés.

Aussi pour les stationnements de peu de durée est-il plus simple d'utiliser l'épuration par la chaleur sans pression.

Les appareils dits François Vaillant qui sont utilisés dans notre Armée depuis 1904 répondent entièrement à cette indication. Ils sont susceptibles de fournir de 250 à 500 litres à l'heure suivant les types, et sont munis d'un dispositif qui permet de ne donner l'écoulement de l'eau que lorsqu'elle est en ébullition.

A ces fourneaux d'un modèle très pratique sont annexées des cruches hygiéniques en tôle d'acier galvanisée d'une contenance de 10 à 20 litres suivant les modèles, d'un nettoyage facile et d'une fermeture hermétique. Elles permettent d'assurer le refroidissement de l'eau bouillie et sa distribution.

L'eau bouillie est consommée par les troupes après avoir été aromatisée avec du thé.

OZONE ET RAYONS ULTRA-VIOLETS.

En raison des propriétás bactéricides de l'ozone et des rayons émis par les lampes en quartz à vapeur de mercure, il était rationnel de recourir à ces méthodes pour épurer l'eau de boisson des troupes en station.

Des installations portatives ont été réalisées qui ont permis d'organiser des postes de stérilisation susceptibles de fournir plusieurs mètres cubes d'eau stérillisée à l'heure.

Mais l'ozone, aussi bien que les rayons ultraviolets, n'est doué de propriétés bactéricides qu'autant que l'eau soumise à ce traitement est exempte de toute turbidité. D'où la nécessité d'associer à ces appareils des installations filtrantes permettant une clarification absolue.

Cette circonstance limite dans une très large mesure la mise en œuvre de ces méthodes d'épuration en campagne.

Toutefois, l'expérience acquise par l'emploi des rayons ultra-violets permet de fonder sur ce procédé les plus grandes espérances.

ÉPURATION CHIMIQUE.

L'épuration chimique le l'eau de boisson qui convient tout particulièrement pour les troupes en marche ou soumises à de fréquents déplacements peut convenir aussi aux troupes en station. Cette méthode doit satisfaire à certains desiderata d'ordre hygiénique qu'il convient de ne pas perdre de vue. Il faut que l'agent chimique employé soit suffisamment énergique pour oxyder rapidement les matières organiques dans l'eau et détruire toutes les bactéries pathogènes. Il est

nécessaire que son dosage soit facile, sa conservation longue et sa manipulation inoffensive.

Comme le degré de pollution des eaux est essentiellement variable, la proportion de substances antiseptiques nécessaires ne peut être fixée en principe. Il est donc désirable qu'on utilise un procédé permettant d'apprécier par un simple changement de coloration si la dose employée est suffisante. Enfin, le traitement chimique ne doit abandonner dans l'eau aucune substance nocive.

La liste est déjà longue des procédés préconisés; le brome, l'iode, l'hypochlorite de chaux, le permanganate de potasse fournissent les meilleurs résultats et leur emploi est à recommander.

Le procédé à l'hypochlorite de soude est certes le plus économique et le plus rapide. C'est évidemment le type des procédés de fortune. Il en est fait usage à l'étranger par beaucoup de villes, particulièrement en Amérique, et nombreux sont les travaux sur le pouvoir bactéricide des hypochlorites alcalins. Récemment encore un médecin militaire de San Francisco, le L^{t} en 1er Alexander Cooper, démontrait que l'eau mélangée à $\frac{1}{200.000}$ d'hypochlorite de chaux était complètement stérilisée après 20 minutes et ne conservait aucun goût désagréable. D'ailleurs, le Maj. Carl R. Darnall doit faire une communication à notre section au sujet de cette méthode et nous montrer les avantages des appareils qui figurent à l'exposition.

On sait que le bactérium coli étant plus résistant à l'action de l'antiseptique que les bacilles de la fièvre typhoïde et de la dysenterie, on est sûr d'être débarrassé de ces derniers lorsque le premier a disparu.

Un volume d'eau de Javel, correspondant à un milligramme de chlore, par litre d'eau à épurer, tue le bactérium coli en 6 heures, mais il faut atteindre 3 milligrammes pour que la mort de la bactérie soit certaine en trois heures. En partant de ces données, il importe de connaître le débit de la source et de faire écouler régulièrement la quantité d'hypochlorite dont la dose varie suivant la longueur du trajet jusqu'au point de prélèvement de l'eau. Mais il ne faut pas perdre de vue qu'il est de toute nécessité de contrôler par des analyses journalières et très fréquentes la teneur de l'eau en chlore, et le cas échéant la déjavelliser par addition de sulfite de soude. Il y a lieu d'autre part de ne pas ignorer que, si la quantité d'hypochlorite utilisée est exagérée la consommation de l'eau peut être nocive.

En somme, la javellisation de l'eau, en raison de la surveillance un peu délicate qu'elle exige, ne paraît pas devoir être recommandée pour donner satisfaction aux besoins d'une troupe en campagne.

ÉPURATION DE L'EAU DES PUITS.

Il est fréquent que la troupe soit obligée de s'alimenter à un puits dont l'eau est suspecte et qu'il est nécessaire d'épurer. On peut assurer

cette opération par le permanganate de potasse (Delorme) ou avec plus de certitude encore en faisant agir le perchlorure de fer sur le chlorure de chaux en présence du permanganate de potasse (procédé Allain).

Pour épurer un litre d'eau et détruire par oxydation toute la matière organique, il est nécessaire d'employer 0.05 à 0.10 centigrammes de permanganate. Le résultat est atteint quand on obtient une couleur rosée persistante pendant une demi-heure. Il suffit alors de projeter dans le puits du charbon de bois pilé mélangé avec du sable fin.

Après trois ou quatre jours la désinfection est assurée, le charbon déposé, l'eau clarifiée.

Cette désinfection n'est efficace évidemment, que si l'infection du puits est d'origine extérieure et que ni le sol dans la profondeur, ni la nappe souterraine ne sont contaminés.

Le procédé Allain qui fournit des résultats plus certains a le grave inconvénient d'empêcher la consommation de l'eau pendant une période de 15 jours après l'époque du traitement. Ce laps de temps est nécessaire pour la destruction spontanée et totale des dérivés chlorés formés dans la réaction. Son utilisation ne peut être qu'exceptionnelle pour des troupes en campagne. La technique de la désinfection d'un puits par cette méthode est la suivante:

Pour 1 mètre cube d'eau on emploie les trois solutions ci-après:

Solution A.—Hypochlorite de chaux	5 gr.
Eau ordinaire	100 cent. 3
Solution B.—Perchlorure de fer officinal	20 cent. 3
Solution C.—Permanganate de potasse	1 gr.
Eau ordinaire	20 cent. 3

L'épuration est satisfaisante après 24 heures de contact; l'eau traitée conserve une couleur violette permanganique. Dans le cas contraire, c'est que l'eau était très souillée, et il y a lieu de faire un deuxième traitement.

PEROXYDE DE CHLORE (PROCÉDÉ BERGÉ).

Sous le nom de stériline on a proposé pour les troupes en campagne une solution aqueuse renfermant par litre 3 grammes de peroxyde de chlore. Un litre de cette solution suffit à stériliser en cinq minutes, un mètre cube d'eau de qualité moyenne, soit un centimètre cube par litre.

Le peroxyde de chlore n'altère pas sensiblement la composition chimique de l'eau.

Il existe un matériel portatif à l'usage des armées en campagne. Le poids de l'appareil et des produits nécessaires pour stériliser l'eau d'un régiment de 1,000 hommes pendant une période de 1,000 jours est de 200 kilos.

Pour faire disparaître l'excès de peroxyde de chlore il suffit de filtrer l'eau traitée sur du coke. Il est facile de se rendre compte si l'eau renferme des traces d'antiseptique en employant comme réactif un mélange d'iodure de potassium avec de l'eau d'amidon.

En présence du peroxyde de chlore l'iode est mis en liberté et colore l'amidon en bleu.

Enfin, on peut envisager l'épuration de l'eau par le ferro-chlore (procédé Duyk), mélange de chlorure de chaux et de perchlorure de fer ou par le carboferryle (filtres Caudy), ou encore par le sulfate d'alumine (filtre Desrumeaux).

Mais ces derniers procédés nécessitent des installations qui ne peuvent être établies qu'au cas de station prolongée, et en quelque sorte permanente de la troupe.

ALIMENTATION EN EAU D'UNE TROUPE EN COLONNE.

L'expérience des campagnes les plus récentes, et particulièrement des campagnes coloniales, a montré la difficulté d'alimenter en eau potable une troupe en marche.

Le soldat qui n'a pas le souci du danger exige avant tout que l'eau qui lui est livrée soit fraîche, qu'elle n'ait aucune saveur médicamenteuse ni aucune couleur anormale, et qu'il puisse la consommer au moment du besoin. Le problème se pose dès lors sous des aspects très différents.

Si sur le continent européen il est possible au prix des plus grandes difficultés de faire suivre la troupe par des voitures stérilisatrices susceptibles de suffire aux exigences de la collectivité, on ne saurait envisager leur emploi dans les campagnes coloniales, où le besoin impérieux de la soif torture le soldat qui marche et qui doit pouvoir se désaltérer partout où il se trouve et boire impunément pour sa santé l'eau de l'oued, du ruisseau ou du marigot qui le tente par sa fraîcheur.

La chaleur et l'épuration chimique sont les seules méthodes à retenir.

Pendant la campagne russo-japonaise, le soldat japonais était muni d'un nécessaire individuel en aluminium permettant la préparation rapide du thé destiné à sa boisson.

Mais il faut compter avec les mœurs séculaires des peuples, et il n'est pas douteux que le dispositif de l'armée japonaise ne serait pas utilisé par les soldats des nations qui considèrent la boisson chaude comme un médicament.

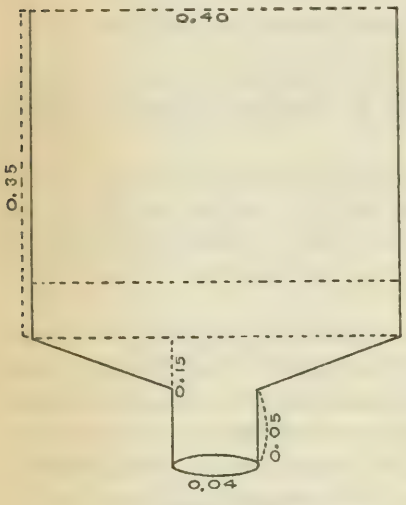
L'épuration chimique reste donc la seule méthode susceptible d'être utilisée en marche.

Le permanganate de potasse associé à l'alun de soude, au carbonate de soude et à la chaux de marbre (procédé Lapeyrère) ; ou au sulfate de manganèse et à l'orthophosphate monomanganeux (procédé

Lambert) ; ou au carbonate de soude et à la chaux (procédé Charles Hy), ou à l'alun, à l'hyposulfite de soude et au carbonate de soude (procédé Laurent) ; ou, enfin, au bioxyde de manganèse, au talc et à l'hyposulfite de soude (procédé Georges Lambert), permet d'obtenir rapidement l'épuration d'une eau qui peut être consommée sans inconvénients.

Le bisulfate de soude (procédé Parkès et Ridéal) ; l'hypochlorite de chaux, le brome associé au bromure de potassium (procédé Schumburg) ; l'iode sous forme de comprimés renfermant de l'iodure de potassium, de l'iodate de soude, et de l'hyposulfite de soude (procédés Vaillard Georges), ont été également utilisés.

Un dispositif simple et pratique a été imaginé par le Médecin-Major Garret et utilisé par les troupes débarquées au Maroc où il rend les plus grands services. Le filtre Garret qui utilise la poudre stérilisante Lapeyrère dite alumino-calcaire se compose d'un cylindre en tôle galvanisée soudé par un de ses bords à un fond de même métal perforé de nombreux trous de trois à quatre millimètres, puis à un tronc de cône renversé terminé par un petit cylindre.



Fevrier VIII.

Un second fond de tôle perforée mais mobile, muni d'une boucle au centre de surface supérieure, sert à comprimer le coton hydrophile étalé sous sa surface inférieure. (Ci-joint le schéma d'un filtre de bataillon.)

Le filtre est disposé sur un tabouret de bois présentant en son centre un large orifice où il s'engage par sa partie conique.

Le matériel nécessaire comporte un tonneau, de la poudre alumino-calcaire, une solution de bisulfite de soude à 20 pour 1,000 et un filtre en tôle galvanisée.

On remplit le tonneau d'eau à épurer, on mélange à l'eau la poudre alumino-calcaire (12 gr. 50 pour 50 litres d'eau), on remue le liquide et on laisse une demi-heure au contact après s'être assuré que l'eau reste rose.

On ajoute à l'eau la solution de bisulfite de soude par petites quantités jusqu'à l'apparition d'une coloration brune.

L'épuration est réalisée.

Il suffit de filtrer l'eau après avoir garni le filtre de coton hydrophile.

Ce coton se place entre les deux lames perforées en une couche d'égale épaisseur, débordant du pourtour le fond mobile.

L'eau sort du filtre absolument claire.

Ce dispositif permet d'épurer de grandes quantités d'eau au moment de la halte ou à l'arrivée à l'étape. Mais au cours de la marche ou quand il est isolé, le soldat doit porter dans sa musette un matériel aussi simple que possible qui lui permette d'opérer individuellement et de préparer extemporanément l'eau nécessaire à ses besoins.

Il suffit qu'il dispose de deux flacons renfermant l'un le permanganate de potasse et l'alun, l'autre l'hyposulfite et le carbonate de soude, d'une petite mesure indiquant les doses nécessaires pour un litre d'eau et d'un petit filtre en chausse.

Muni de ce matériel, il est à même d'épurer en 10 minutes la quantité d'eau nécessaire à sa boisson.

CONCLUSIONS.

La fièvre typhoïde, la dysenterie bacillaire ou amibienne, le choléra, maladies très meurtrières pour les troupes en campagne, sont le plus souvent transmises par l'ingestion d'une eau de boisson spécifiquement polluée.

Malgré la pratique de la vaccination antityphoïdique il y a lieu de prévoir l'épuration de l'eau de boisson livrée aux troupes.

En station, les procédés qui utilisent la chaleur avec ou sans pression, la filtration sur sable non submergé sont les plus recommendables.

Pour les troupes en marche et, à défaut de voiture stérilisatrice, accompagnant les colonnes, l'épuration chimique par le permanganate de potasse, associé à des agents réducteurs, fournit les meilleurs résultats.

Chaque unité tactique doit être pourvue du matériel nécessaire à l'épuration chimique de l'eau.

Chaque soldat doit être muni d'un filtre individuel et du matériel nécessaire à cette épuration.

Il y a lieu de poursuivre des recherches en vue de l'utilisation pratique de l'ozone et des rayons ultra-violets pour l'épuration de l'eau en campagne.

THE PURIFICATION OF WATER FOR TROOPS IN TIME OF WAR.

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The conditions obtaining in armies are so different from those in civil communities, and these conditions sometimes change so rapidly from day to day, that the provision of an adequate supply of potable water is ordinarily a very difficult undertaking. The conditions are so varied that it may be well to consider the subject under the following heads:

1. *Permanent garrisons.*—In times of war, more or less permanent garrisons, cantonments, and camps are maintained at various points, both within and without the theater of actual operations.

Such garrisons simulate, in their general constitution and needs, permanent civil communities, and the same methods of water purification used in towns and cities may be employed to advantage. Indeed, in many cases such garrisons are within or near cities, and the necessary water supply may be obtained by a mere extension of the system already in operation. The problem presented in such a case is usually comparatively simple and not difficult of solution.

2. *Temporary camps.*—Here the difficulty of supplying pure water is usually vastly increased, chiefly on account of the inadequate existing supply of pure water, which makes it necessary to institute special methods of purification.

A dense population is suddenly thrust upon a countryside where the wells are perhaps inadequate, even if their water is pure, and the use of water from more or less polluted streams becomes unavoidable. The method of water purification chosen under these conditions must be easily and quickly installed, of adequate capacity, and must be reliable, if it is to be depended on for satisfactory results.

3. *During marches.*—Here the conditions are again different and more difficult to meet. The troops are changing location frequently, perhaps daily. Much of the day and night is taken up in movement with little or no opportunity to select the source of water supply. They are compelled to take what can be secured irrespective of its source. If water is to be carried by the men during the march, it must be sterilized or purified, as a rule in camp, and the method chosen must be easily applied, and, to be effective, must be carefully supervised.

4. *In the presence of the enemy.*—When a general engagement is in progress or is imminent, the conditions are again different, and it will frequently be difficult or impossible to employ any method of purification, even the simplest. The method used will usually be one which can be carried out by the individual soldier, or at most by

small parties. No general supervision is possible, and very little or nothing can be done to select or protect the source of supply. Fortunately, such conditions are transitory, lasting, as a rule, only a day or two, or a week or so at the longest.

METHODS OF WATER PURIFICATION.

The recognized means of purifying water for human consumption may be classed as follows:

Mechanical: Embracing (*a*) sedimentation; (*b*) slow sand filtration; (*c*) rapid filtration after the application of certain agents which cause precipitation; (*d*) filtration by specially constructed filters of the Pasteur type.

Physical or physico-chemical: Including (*a*) heating by boiling the water; (*b*) heating above the thermal death point of the pathogenic organisms; (*c*) the ultra violet rays.

Chemical: (*a*) Chlorine and chlorine compounds; (*b*) iodine; (*c*) bromine; (*d*) ozone.

The chemical methods mentioned are practically all oxidation methods, the oxidation being accomplished by nascent oxygen.

The methods enumerated vary greatly in ease of application, time involved in putting into operation, cost, and availability under the peculiar conditions arising in time of war. These questions will be taken up in connection with the discussion of the particular method or methods to be selected for supplying pure water under the conditions stated in section 1 of this paper.

Permanent camps, cantonments, and garrisons.—The method of purification selected will depend of course upon several factors. If the camp or garrison is near a large civil community having a piped water supply of good quality (whether naturally or by purification), the problem is easily solved by piping such pure water into the camp and properly distributing it.

If the water is not pure, but the supply is sufficient, it may be purified before use for drinking, and it is much better if the whole supply can be purified.

Unless the city already has the plant, slow sand filtration is not available, as much time is required for construction.

Rapid or mechanical filtration can be put into operation within a few weeks or months, but not quickly enough.

Special filters may be used, but their operation is expensive, and the output is so small that sufficient water for drinking purposes only can usually be filtered.

The writer devised the small filter now in use by the United States Army and it has thus far proved quite satisfactory for camp use. It is of the type used in conjunction with a coagulant and has a

capacity of about 50 gallons per hour. For large, permanent camps, however, these filters, on account of their small capacity, are not recommended, except for a very limited period of time while some other more satisfactory method is being installed.

Purification by heat, ozone, iodine, bromine, or ultra violet rays is also not well adapted for permanent camps, chiefly because it is impracticable by any of these methods to purify all the water used in the camp.

To be considered available for purifying the total supply for large camps a method must be capable of rapid installation. The only methods which at the present time meet the requirements employ chlorine as the active agent, either in the form of the gas itself or as a hypochlorite.

The proper place to apply the chemical (either chlorine or hypochlorite) is at or near the source of supply, not at the camp itself, and, if the camp is near a town having the same unpurified water supply, the purifying agent should be used at the common source, in order to remove the danger to the troops of contracting water-borne diseases while visiting the town.

Hypochlorite of lime may be used in proper quantity, the dosing being done by one of the devices well known in engineering practice. But, as this method requires very careful regulation and frequent assays of the hypochlorite, in order to avoid overdosing, and thereby imparting an unpleasant taste to the water, it is believed that the liquid chlorine process, devised by the writer, is better adapted for camp use, since it is free from the objections mentioned.

In this process dry chlorine, liquefied by pressure and contained in steel cylinders, is used. The gas, after passing through a simple pressure regulator, is admitted in proper quantity to the water pipe through which the water (while the apparatus is in operation) is caused to flow at a fairly uniform rate. The water absorbs the chlorine readily and the sterilization is practically instantaneously accomplished. The best place to apply the gas is at or near the pump supplying the camp, where it can be operated by the force operating the pumping machinery. A simple color test, either with starch-iodide paste, or with a 1–1000 solution of orthotolidin, may be made as often as necessary.

This apparatus is easily operated, can be attached to any water main or pump, is durable, effective, and the installation can be made quickly. The cost will rarely exceed 40 cents per million gallons of water treated.

Temporary camps.—In temporary camps, where the conditions are such that provision can not be made for a general water supply and the troops must depend on wells and streams, the method selected

must be adapted to the treatment of comparatively small quantities of water. For convenience (a piped supply being impracticable), small subdivisions of troops should be equipped to purify the water required for their own use. It is believed that each regiment or, preferably, each battalion should be provided with its own means of purifying water. Under such circumstances, filtration on a large scale is impracticable.

Boiling or heating in specially devised apparatus is very expensive and usually impracticable, on account of the difficulty of procuring and transporting sufficient apparatus and fuel. Heating by ordinary vessels (without some system of heat exchange) is feasible, but the water can not be used until cool, is usually insipid, and is not highly esteemed as a beverage by the troops.

The ultra-violet rays method is yet in an experimental stage, requires complicated electrical machinery, and is not effective with turbid waters.

The ozone method is unsuitable, because the water treated may vary greatly in organic content, and time is required to make analyses.

The chlorine and iodine methods may, under certain conditions, be the best, but their efficiency also is governed largely by the organic content of the water.

Filtration with coagulation.—As a generally useful method, I believe this to be the best. The method was employed by the Japanese in Manchuria, the Ishiji filter being used to separate the sediment.

The filter devised by the writer, and referred to above, has advantages over the Ishiji filter in that its capacity is greater and less time is required to get water after putting the apparatus into operation, as it is unnecessary to wait for sedimentation after adding the precipitant to the water. The water to be purified is treated with a coagulant powder (an aluminum or an iron salt combined with a neutralizing agent, such as soda, potash, or lime).

This powder, in the presence of water, forms a flocculent precipitate which is removed by filtration through a cloth wound on a siphon. The filter cloth is sterilized by boiling before it is used. The capacity of this filter is sufficient to provide in four hours drinking water for 300 men.

Marches.—The possible methods for supplying pure water during marches are limited to the following:

1. The water must be purified in camp, and carried either by the individual soldier or in water carts or wagons.
2. Chemicals such as iodine, bromine, and the like may be used.
3. Filters which can be put into operation quickly.

The first method will not be discussed, as it is merely an application of the method used in camp. In regard to the second it may be said that it has been used by the French, and also in India, but to what extent I do not know.

It is applied by the individual soldier or by small groups or detachments. The iodine or bromine is added in excess and is then, after allowing a certain time for sterilization, neutralized by a suitable agent, such as sodium hyposulphite. It is said to be effective.

The chief objection to this and similar methods, when execution is intrusted to the soldier, is that they are not likely to be properly carried out on account of the indifference of the men or because of the disagreeable taste, imaginary or real, imparted to the water.

4. Coagulation, followed by filtration, can be used on the march. The small filter described above can be put into commission in about six minutes, and, by having it available, by carrying it in a wagon or cart or by pack animal, may be used even during short halts of the regiment or battalion.

When used on the march the filter, with a fresh cloth wound on the siphon, is sterilized by boiling at the cook's fire, and is then put in its crate ready for use when required.

SUMMARY.

1. (*a*) For permanent garrisons, cantonments, and camps, the whole water supply should be safe.

(*b*) In addition to this, the water supply of neighboring towns and villages, frequented by the soldiers, must be carefully scrutinized and, if necessary, purified.

(*c*) Where the water requires purification and no effective method is already in operation, it is believed that purification by liquefied chlorine gas has advantages over all other methods in that it may be quickly installed, is cheap, efficient, and easily operated.

2. (*a*) In large temporary camps and during marches it will, as a rule, be feasible to purify the drinking water only.

(*b*) The purification should be intrusted only to specially trained detachments under the direct supervision of officers qualified for this work.

(*c*) The most generally applicable method of purification for large bodies of troops in temporary camp or on the march is believed to be coagulation with suitable chemicals, followed by rapid filtration.

THE INFLUENCE OF HIGH WET-BULB TEMPERATURES IN THE ENGINE ROOM AND STOKEHOLDS OF SHIPS IN THE TROPICS.

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The temperature of the body is the expression of the resultant of the balance between heat production and heat loss, and must vary from minute to minute; for instance, a series of observations made by the writer, over a period of six weeks' voyage to India, showed a range of rectal temperatures of from 98.2° F. to 102.6°, and of mouth temperatures of from 97.5° to 99.6° F.

The heat of the body is regulated by (1) regulation by heat production and (2) regulation by heat loss. The first is a chemical agency; the second, a physical one.

(1) Regulation by heat production includes all that is expressed in the words "rest" and "work." A resting soldier, weighing 70 kilos, produces 1.2 to 1.3 calories of heat per minute; whilst marching with a load of 31 kilos, he produces 7.73 calories per minute, sufficient to raise the body temperature 1.8° F. in 8.7 minutes.[1] The period of the day at which the body temperature is at its lowest corresponds to the time of most complete rest, in the average man, about 4 a. m.

(2) The second method of heat regulation is by physical means, by evaporation, conduction, or convection.

Evaporation.—The evaporation of 1 gram of water at the body temperature requires about 0.55 calorie. In one experiment carried out in the stokehold in the Tropics, working for two hours with a wet-bulb temperature of 84° F. and a dry-bulb of 104° F., 2½ pounds of water was lost; or, roughly, by this means alone 500 calories were got rid of. The rate of evaporation of the sweat will depend on the relative humidity of the surrounding air.

Conduction.—Cooling by conduction will depend on the relative temperatures of the body and of the surrounding air, and on the coefficient of cooling of the body. This will depend on the form of the body, color, condition of the surface, clothing, the presence of layers of subcutaneous fat, and so on.

The small animal loses heat much more rapidly than a large one, so that the small, wiry stoker will lose heat more rapidly than the fat one, apart from the fact that fat has only half the conductivity of heat that muscle has. The metabolism of a man weighing 180 pounds, and of one of 120 pounds, is as 3 is to 2, but, on the other hand, the fat man will lose heat by water evaporation at a much greater rate than the thin man.

In color the negro has an advantage as regards evaporation. It is curious that coal trimmers, working in the bunkers of ships, are not more liable to heat stroke than are those at work in firing the furnaces, for the bunkers are, as a rule, hotter than the stokeholds,

whilst the air in them is almost motionless. An explanation may be found in the fact that the worker in the bunkers is at once covered with a thick layer of coal dust, which will radiate heat much faster than the uncovered body. An animal covered with a coat of varnish will die from the rapid rate of cooling.

Clothes lessen the heat loss, but this loss will be modified by the relative power of the material to absorb the sweat, as water is a better conductor of heat than air.

Convection.—Heat radiation will vary with the movement of the air, the rate of heat loss being proportional to the square root of the velocity of the moving air.[2]

Overeating may enormously increase the metabolism of the body. In the severe cases of heat stroke observed by the writer nothing impressed itself more on the memory than the enormous amount of undigested food that was brought away from the bowel by rectal injections or got rid of by vomiting.

In this connection it has been shown [3] that with the rise of internal temperature there is a great increase in the consumption of the body carbohydrates, and it is suggested that carbohydrates may play a great part in the resistance of the body to overheating (cf. the devotion of tropical natives to a carbohydrate diet). It is possible that the amount of meat in the dietary of our sailors might be reduced, and more carbohydrates substituted, with a corresponding advantage, as soon as the wet-bulb temperature reaches 80° F.

Of the part played by the nervous mechanism in the regulation of the body temperature so little is known that it is useless to speculate about it.

It has been shown, experimentally,[4] that—

(1) Rectal temperatures did not show any abnormal increase during rest in still air until the wet-bulb thermometer reached about 88° F., provided that the subject were stripped to the waist or clad in light flannel. If, however, the wet-bulb temperature exceeded this by even 1°, a very marked rise of rectal temperature occurred.

(2) In moving air (with the wet bulb still below the body temperature) a higher wet-bulb temperature could be borne without abnormal rise of rectal temperature. Thus, in an air current of about 170 linear feet per minute a wet-bulb temperature up to about 93° F. could be borne without abnormal rise of body temperature.

(3) Muscular work lowered the limit of the wet-bulb temperature which could be borne without rise of body temperature both in still air and in a current of air; in the latter case 87° F. was beyond the limit within an air current of 135 linear feet.

Judged from the above considerations, the engine rooms of ships which, as a rule, are not fitted with forced artificial ventilation, should present ideal conditions for the production of heat stroke;

but there is a saving clause to be found in the absence of any severe muscular exertion so long as the engines are running, the attention then practically amounting to carrying around an oil can. In the stokehold the conditions are reversed. Here we have severe muscular work being carried out in an air current that may be anything from 150 to 600 linear feet or more. The work is of an intermittent character. The actual throwing of the coal on the fires has to be done in quick time, to avoid the cooling action of the air on the fires and the consequent loss of steam. In the same way the cleaning of the fires can not be a leisurely performance, and it involves the breaking up of the clinker with a "slice," a heavy iron bar provided with a wedge-shaped head, the whole weighing from 60 to 80 pounds, and the rapid withdrawal of ashes and clinker with a rake. All this time the stoker is exposed to the intense heat and glare of the furnaces. Still, between each of these outbursts of energy he has periods of rest in an air current, and the air current increases in intensity the harder the steaming is.

During the early hours of the morning of the 9th of September, 1908, 11 cases of heat stroke were brought to the sick bay of H. M. S. *Fox*, a British cruiser passing through the Red Sea on her way to the East Indies Station.

On the previous evening I had spent the dogwatch in working in the stokehold. The temperature then was 84° F. wet and the dry bulb was 104° F. Work was carried on in an air current of 400 linear feet per minute. My rectal temperature after two hours' work was 102.6°, and I was feeling the effects of the experiment so much that it was with difficulty that I could stand to take the final rectal temperature.

To ascertain if the stokers showed any corresponding rise of temperature I obtained the urine temperatures of five of the men on their return from the stokehold, with the following results: (1) 102.4° F., (2) 98.5°, (3) 99°, (4) 102.2°, (5) 99.4°.

The temperature of the engine room at midnight, when the first case was brought to the sick bay, varied with the position from 87° F. wet and 104° F. dry at the after end to 96° wet and 115° dry near the starting platform forward, whilst the stokehold averaged about 87° wet and 107° F. dry. On deck the wet bulb was 85° and the dry bulb 91.5° F.

It will be noticed how closely the conditions agreed with the conclusions stated above.

The practical conclusions to be drawn from the above considerations are:

(1) The necessity of careful observations on the wet and dry bulb temperatures in the engine room and stokehold when steaming in the Tropics.

(2) The provision of ventilating fans in the engine rooms of all ships, so that work may be carried on in a brisk current of air.

[1] Zunts and Schomberg, quoted by Hill: Recent Advances in Physiology and Bio-Chemistry. (Arnold, 1906.)

[2] Schuckmann, quoted as above.

[3] Sutton, Journal of Pathology and Bacteriology, Vol. XIII, p. 63.

[4] Haldane. The Influence of High-air Temperatures. Journal of Hygiene, 1905.

HYGIENE OF THE ENGINE-ROOM FORCE, WITH SPECIAL REFERENCE TO THE MITIGATION OF THE EFFECTS OF HEAT AND HUMIDITY IN THE ENGINE ROOM UNDER CERTAIN ASSUMED BATTLE CONDITIONS.

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The introduction of steam as a motive power for naval vessels, some 90 years ago, marked the beginning of a new era in naval architecture, one which in its bearing upon ship hygiene was as important as the change from wooden to metal construction of ships, which took place about 20 years later.

As soon as steam became a reliable means of propelling vessels of war and could be depended upon for maneuvers, there commenced the evolution of marine engines of greater and greater power—an evolution which continues at the present day.

Recently we have witnessed the change from reciprocating engines to turbines, and already the advent of new types is foreshadowed.

With the appearance of each new type of engine new problems in naval hygiene have arisen, and this science has been ever on the alert to ameliorate the adverse conditions under which the engine-room force has worked. These conditions, from the nature of the situation, have been difficult to influence favorably, especially in the radical manner demanded by naval hygienists.

Adequate recognition of the importance of certain sanitary problems in the engine room, particularly those affecting ventilation in battle, has resulted largely from a study of the events of the naval engagements of the Russo-Japanese War. Certain incidents of that war served to show that special provision must be made during battle in order to insure the safety and integrity of the force below, and the dangers which threaten the efficiency of this force during a naval engagement are now more accurately known and appreciated.

Since the inception of the marine engine the major attempts at hygienic betterment in the engine room have been directed toward improvement of ventilation, and the sanitary history of the engine-room space in its early period of development was largely the history of the rise and decline of appliances which sought to provide an

adequate supply of air and thereby reduce excessive temperatures. This warfare of hygiene against excessive heat in engine rooms still continues, and in the development of the internal-combustion engine for ship propulsion the satisfactory disposal of excessive heat remains a most exigent problem.

Owing to the introduction and improvement of the modern ventilating fan much of the discomfort from heat formerly endured by the engine-room force has been greatly mitigated. Serious complaint arises now only under certain extreme conditions, conditions that are more likely to be present in time of battle than in peace time. When, however, a situation arises where artificial ventilation must be wholly eliminated, as may happen in an exigency of battle shortly to be described, then conditions ensue which threaten the physical integrity of the engine-room personnel, and, perhaps, affect the value of the ship at the moment when she is seeking to exert her highest function.

To ameliorate these conditions and maintain the engine-room force in a state of physical efficiency during battle is one of the most vital problems engaging naval hygiene to-day, for the outcome of battle may well depend upon the continuous physical integrity of the engine-room personnel. Therefore, recent efforts have been concerned with the devising of some expedient whereby this personnel may continue its labors under certain exigencies of battle when ordinary ventilation may fail.

Before proceeding with the discussion of this question it is advisable to state the circumstances under which this contingency of stoppage of ventilation in the engine room during battle will arise.

The reports of the Russo-Japanese war indicate that a ship, against which a shell containing high explosive may burst, or whose smokestacks are perforated, or upon whose decks fires occur, remains for some time enveloped in an atmosphere of smoke and noxious gases which, being drawn into the ventilating systems, are delivered to compartments below in sufficient concentration to imperil the efficiency of, if they do not absolutely overcome, the personnel there. In battle, therefore, it may become necessary to run ventilating fans intermittently or stop them altogether.

To facilitate the solution of this problem, and to obtain some idea of the conditions that will result in an engine room under circumstances approximating as closely as possible those assumed to prevail in battle, it is proposed to describe an attempt to simulate them by experiments in a modern ship. A description of two such experiments follows. The first was made under assumed battle conditions, with ventilation entirely stopped, and the second under similar conditions, with ventilation operative.

FIRST EXPERIMENT.

The engine-room force were at their usual stations and the ship proceeding at full speed. The engine-room hatches were placed in position, flash plates secured over ventilating intakes, and water-tight doors and armored hatches closed. The senior surgeon of the ship was stationed in the starboard, the junior surgeon in the port engine room, both prepared to take observations and note effects upon the personnel. The engine rooms were thus secured at 1.17 p. m., the ventilation then being absolutely shut off.

Air neither entered nor escaped from the engine-room compartments after this time and until the conclusion of the test.

The net air space, calculated from the cubic contents of the engine room, was about 3,100 cubic feet per capita. The temperature of the outside air on this date was, by dry bulb, 78° F., by wet bulb, 73° F. The barometer stood at 30 inches, and the relative humidity was 79 per cent. The engine-room temperature at the beginning of the experiment on the operating platform, at which level most of the personnel worked, was 110° F., and at the termination of the experiment, some 18 minutes later, it was 126° F.

We were thus immured in a closed compartment of limited size containing extensive heat-radiating surfaces, with no renewal of air, and with an initial per capita air allowance of 3,100 cubic feet. At first one felt only such moderate discomfort as might be expected in such temperatures. Conditions were at first entirely tolerable, but with the progress of time, counted by minutes, the degree of physical discomfort and the oppression became insupportable. Nearly everyone present soon commented upon the very apparent stagnant condition of the air, some remarked a fullness in the head, and others had slight nausea and dizziness. My own personal experience culminated in a violent headache and a feeling of extreme physical exhaustion. The objective symptoms were even more noteworthy. All individuals presented a much accelerated pulse rate, and in a number of them the body temperature rose to a point several degrees above normal. In one individual the rise was as much as 3.4° F. The following changes in pulse rates were noted:

Beginning of test.	Termination of test.
100	162
98	144
98	132
80	140
82	132
84	168

In the limited time elapsing before the conclusion of the experiment, only 18 minutes, but few observations were practicable, and such as were made had, of course, to be made upon men actively engaged in their usual duties and amid the noise and confusion of moving machinery. The opinion was universal, however, that adverse effects, and possibly complete disability, would follow from the conditions imposed if persisted in for long. While the engine-room temperature, judged by ordinary standards, was by no means excessive, the feeling of physical oppression was overwhelming and the experiment was advisedly terminated at the end of 18 minutes.

SECOND EXPERIMENT.

The conditions of the second experiment were exactly those of the first, except that in the second ventilation was maintained at its normal capacity and a vent

provided for redundant air. The outside temperature on this date was materially higher than that of the day on which the first experiment took place. The dry-bulb temperature of the outside air was 92° F., the wet bulb 88° F., the barometer stood at 30.08 inches and the relative humidity was 85 per cent. In the engine room the temperature ranged from 126° F. to 128° F.; the wet bulb from 105° F. to 108° F. The relative humidity was from 49 to 52 per cent. In order to insure an exact comparison these observations extended over a period of time nearly equal to that of the first experiment.

While the temperatures in this second experiment ranged much higher than in the first, the feeling of discomfort on the part of the occupants was materially less. The sensation of deadness or stagnation of air, complained of on the previous occasion, was not so noticeable, and the physical signs of pulse acceleration and rise in body temperature were found only in a minor degree. It was evident to all who participated in both experiments that in the second there was a capacity for adjustment to the prevailing conditions of heat and humidity, even though they were more extreme, that did not exist in the first. Upon what element or factor did this difference in the results of the two experiments depend?

It is a well-known fact that the human economy is capable of automatically regulating its temperature, within certain limits, by sympathetic response to external conditions, but this response has been found to be largely dependent upon the atmospheric environment, especially upon that very important factor, relative or percentage humidity. Only so long as the air remains able to take up moisture from the skin surfaces, and from the exhaled air of the lungs, does this regulatory mechanism for maintaining constancy of body temperature operate successfully. When, for example, the air immediately surrounding the body is warmer than the body and approaches a condition of relative saturation, or a high relative humidity beyond a certain limit physiological adjustment fails, the body temperature tends to rise, since loss of heat by evaporation of surface moisture into the layers of air about the body is much retarded, and from a lessened loss of heat, or a lessened expenditure of heat, there results an increased accumulation of heat. With this rise in body temperature goes a constantly accelerated pulse rate. There then ensue all the symptoms of discomfort experienced in a badly ventilated and overheated room.

In spaces where very high temperatures prevail, as in the first experiment, doubtless more serious effects, such as heat stroke, might eventually result, since the difficulties of physiological adjustment are then much increased, even if, as compared with lower temperatures, the percentage of humidity is less.

These experiments, therefore, go far to attest the value that has in recent years been assigned to the factors of heat and humidity in relation to ventilation, and to invite attention to the importance of keeping them at the level most appropriate to a maintenance in heat equilibrium of the heat-regulatory mechanism of the human organism, especially when higher temperatures are involved, as in the present instance.

The prevailing attitude of hygienists, in agreeing upon the importance of these factors of heat and relative humidity in connection with ventilation efficiency, has come only after many years of elaborate research, and a brief review of the progress of this branch of sanitary science is not without interest in this connection.

When numerous observations and experiments failed to make the carbon-dioxide content of the air responsible for the evil results of poor ventilation, hygienists turned to the theory that organic pollution from the expired air of the lungs was responsible, and ventilation sought to remove the deleterious matter, whose concentration in the air of inhabited apartments was assumed and of which the carbon-dioxide percentage formed the index. Long before 1887, when Brown-Séquard and d'Arsonval conducted the experiments which seemed to lend support to this theory of organic pollution, it had been experimentally determined by Le Blanc, in 1842, that carbon dioxide alone could not be held accountable for the injurious qualities of confined air, and the theory of specific toxicity of expired air never achieved any adequate proof. Quite recently, however, Rosenau and Amoss [1] have demonstrated the existence of an anaphylactic reaction in guinea pigs when they are injected with the blood serum of individuals whose expired air had been previously condensed and used to inject these same animals. This experiment would apparently indicate that the expired air does contain proteid matter which served to sensitize the guinea pigs toward proteids in the serum of the persons from whom the first proteid was derived. The exact hygienic significance of these findings still remains unsettled, but it is not at present clear that they lend support to the former contention of a specific organic poison in expired air being responsible for the ill effects of bad ventilation.

Finally, in recent years elaborate series of experiments have been carried out by a number of observers, the results of which go to show that the subjective sensations and feelings of discomfort experienced by those who are confined in closed apartments, inadequately ventilated, are due to elevation of temperature combined with a steadily increasing relative humidity. A brief mention of one of these experiments will reveal their general character and serve to indicate their analogy to the engine-room experiments hereinbefore described:

Heymann, Paul, and Ercklentz,[2] working in Flügge's laboratory, in 1905, found that when a man was confined in an air-tight box no discomfort was felt until the temperature and humidity had increased to a certain point, and that, when the confined air was set in motion by a fan, the disagreeable sensations were relieved. Similar experiments have been carried out by Benedict and Milner,[3] by Leonard Hill and his colleagues,[4] and by Prof. Theodore Hough.[5]

Without going into details it will suffice to state that these experiments were entirely conclusive as to the important influence exerted by heat and humidity upon the human body.

When, as in the engine room, the temperature of the air usually equals or exceeds that of the body, and there is no circulation of air sufficient to modify humidity, we shall soon find the heat-regulatory

apparatus failing to adjust itself to surrounding conditions, and, in the absence of some means of securing agitation of the air immediately about the body and its replacement by air with a lower moisture content, there will appear the physical and pathological effects previously noted.

In the second experiment, while the relative humidity and the temperatures were materially higher than those that prevailed on the day of the first experiment, the important agent for overcoming the ill effects of heat and humidity, namely, efficient ventilation, was fully operative, displacing the air in closer relation to the body and resulting in comparative comfort. In the first experiment, on the other hand, it seemed as if a layer of hot, humid air hung closely about the body, effectually preventing heat radiation and conduction, and resulting in a feeling of positive discomfort.

Unfortunately, the immediate future promises no relief from excessive heat in engine rooms, but if it be true that simple agitation of the contained air of the engine-room compartment, whose ventilation in an exigency of battle is required to be interrupted, will enable the occupants to maintain themselves temporarily in a condition of unimpaired vigor, then the remedy for this difficulty, in view of the results obtained by Flügge and others, appears obvious. It may be remarked here that all present estimates indicate that the naval battle of the future promises to be a matter of minutes rather than of hours, and, therefore, the emergency calling for interruption of artificial ventilation may be only of short duration.

Our purpose, then, is to seek some means of continuing the air movement in the engine room under the contingency of stoppage of the ordinary ventilation. In the experiments carried out by Flügge, Hill, Hough, and others, this movement of the air was effected by ordinary electric fans. It is submitted that the same results may also be achieved in ships, without augmenting apparatus, by simply cutting off the air supply entering the blower by way of the intakes from the upper deck and opening the blower inlet into the general air space of the engine room. We should then have the fans and blowers actively churning up the contained air of the engine-room compartments.

While this arrangement is admittedly largely theoretical and will require the test of experiment to establish its worth, it is believed that all previous experimental evidence makes it highly probable that it would be effective for a short period of time during an engagement. The adoption of a simple expedient like the one here described would further eliminate the necessity for considering more elaborate means of relief, such as would be implied in the use of compressed air recently suggested by Bastier[6] and other writers.[7]

Neutralization of the noxious gases by chemicals, which has also been proposed, does not at present appear practicable.

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[1] Rosenau and Amoss: Organic Matter in Expired Breath, Jr. Med. Research. No. XXV, p. 35, 1911.

[2] Heymann, Paul. Ercklentz. Flügge: Zeitschrift für Hygiene und Infectionskranheiten, 1905. XLIX.

[3] Benedict and Milner: Experiments on the Metabolism of Matter and Energy in the Human Body, Bulletin, No. 175, Dept. Agric. U. S. Exper. Sta. 1907.

[4] Hill, Leonard, Rowland, R. A., and Walker, H. B.: The Relative Influence of Heat and Chemical Impurity of Close Air. Jr. Phys. 1910. XLI, p. 3. (Proc. Phys. Soc. Oct. 15, 1910.)

[5] Hough, Theodore: The Physiological Aspects of Ventilation. Am. Pub. Hyg. 1910. XX, p. 262.

[6] Bastier: La ventilation pendant la combat. Archives de Médecine Navale. December, 1908.

[7] Gloaguen: Preparation du service de santé au combat. Archives de Médecine et Pharmacie Navales. April, 1912.

HYGIENE OF ENGINE AND FIRE ROOM FORCE, WITH SPECIAL REFERENCE TO VENTILATION.

Surg. R. C. Holcomb, United States Navy.

Upon the efficiency of the fire-room and engine-room force in time of war may depend the outcome of battle. The ship that can develop the best speed can certainly decide the question of the range at which a battle may be fought. With a semiprostrated crew in the engine and fire rooms in a ship designed only to meet peace-time conditions, the needed speed may not be developed and the expectations of a worthy engine designer defeated.

I have elected to discuss this question of ventilation under battle conditions, for, after all, what a ship may be expected to do at this time is paramount to every other condition of her existence. The ship herself will yield nothing that is beyond the physical endurance of the personnel. Thus, whatever may be the power of steam, steel, or explosives, we find ourselves confronted with the problem of reducing to the minimum any deleterious factor which may tend to lower the endurance of the man.

The most baneful influence which may reduce the physical endurance of the engine-room or fireroom force is excessive heat or humidity. Amid these conditions a point may be reached where work requiring severe exertion is a physical impossibility, and this fatal point is a hundredfold more possible in a ship battened down for battle conditions than under peace conditions, whether the sailing be in fair or foul weather.

Before we consider the ventilation for battle conditions it may be well to recall the conditions under which the bluejacket lives in the modern dreadnought. Considering the ship as a habitation, from the level of the armor belt the ship is divided from port beam to starboard beam, and from bow to stern, into a multitude of living compartments. Unlike a habitation on shore there are no windows to let in either the sunlight or the fresh air. Through these living compartments often pass steam pipes, or adjacent to them are auxiliary steam-pipe passages generating a heat unknown in the habitation on shore. Here men live with an allotment frequently of less than 400 cubic feet of air space per man. This is their sleeping room, this is where they mess, this is their allotted home, where they come to rest after a hard watch below. The air which comes to these compartments is usually forced into them by means of a multivane fan, but the foul air, to get out, must find its own way to the passages, and from the passages it must rise and pollute the upper levels, until at last it reaches a hatch or port. The amount of air that is forced in is usually sufficiently abundant to supply the respiratory demands for oxygen, and to sufficiently reduce the CO_2 content to make it a negligible factor as a means of harmful pollution. But it is insufficient in itself as a factor to reduce the superheated condition of these compartments under tropical conditions.

This system of ventilation, then, may be described as a forced or artificial supply and a natural exhaust. Adapted as it may be for peace-time conditions, it is absolutely inefficient under battle conditions.

Let us consider battle conditions. Now the watertight door is closed and the air has no means of exit. I have stood under a louvre in a living compartment before the door was closed, with an aneroid barometer in my hand reading 30.12 inches. A good stream of air was being delivered. The door was closed, the barometer immediately arose to 30.20 inches, and the air ceased to be delivered. Ventilation had stopped. The temperature rose 4 degrees in 7 minutes, the temperature of the outside air being but 74° F. It may be seen from this simple experiment that as soon as ready means of exit was interfered with the supply stopped. I refer to this experiment to show that in a modern dreadnaught, with its many compartments, which are closed and made tight for battle, supply alone is inadequate, and a combined system of supply and exhaust must be provided.

The engine-room hatch of the old ships is a thing of the past. Turret guns now shoot over these areas, and, in time of battle, the gun fire, if they were open, would destroy the personnel and wreck the engines. Experimental firing over the engine-room hatches of a United States dreadnought has proved this. Battle conditions now demand that these hatches be closed.

I propose to describe two runs of a ship of the dreadnought type, one a full-power run and the other a run under ordinary battle conditions.

The power run was made in April, and covered a full 24 hours. The cubic air space per man amounted to 2,408 cubic feet for each engine-room, and 1,055 cubic feet for each fireroom, except one, for which the cubic air space per man was 611. The ventilation of the engine room during the forced-draft run was good. The hatches were not closed, and the artificial ventilation system was running. The temperature here did not go above 94° F. The firerooms were airy and well ventilated, the forced-draft blowers being on. The firerooms were always cooler when forced draft was used. The temperature here was, most of the time, lower than in the engine-room, and during the 24 hours of the run did not go above 90° F. The temperature in the engine-room ranged between 86° and 94° F. The temperature of the firerooms ranged from 85° to 90° F., and the temperature of the outside air during the same period ranged from 40° to 60° F. The air of the engine-room was saturated with oil from the forced lubrication system. The amount of oil here was such that it dripped from the oil caps and wet the clothing of the men on duty.

No CO_2 observations were made.

What a contrast there was between this and a run made under battle conditions! The crew went to quarters and the engine-room hatches were shut down at about 6.32 a. m. They remained closed until 8 a. m., at which time the temperature on the upper grating in the port engine-room was 168° F. The effect upon the men was to produce rapid exhaustion. The conditions were such that, if anything had happened below, it would have been impossible for the men to have done anything requiring exertion. The cause of this excessive temperature was that all ventilation was cut off, and conditions were such as, in my opinion, would be fatal in battle. The heat, rising through the engine-room hatch, swept across the deck through an open door on either side, in a well-defined current, to a shutter in a supply ventilator, and thence directly back into the engine room. The highest temperatures recorded were as follows: Upper grating, port 168° F.; upper grating, starboard, 160° F.; lower grating, port, 130° F.; lower grating, starboard, 125° F.; lower platform, port, 118° F.; lower platform, starboard, 117° F. The temperature of the outside air was 81° F.

To this may be added the fact that, owing to the forced lubrication, the air was humid with oil and moisture beyond the point of saturation. The compartments through which the exhaust air from the engine room had been sucked were, as a result of the high humidity, dripping from bulkheads and overhead. The effect upon the person-

nel was very severe. The watches were changed about once in 10 minutes. Several men complained of faintness and exhaustion. The chief engineer's pulse rate was 162 at the end of the run, and the drawn and ashen color of his face showed only too well the strain he was under. My own feelings, after visiting the engine room, were of weakness and the most extreme lassitude I have ever felt. If, as might happen in time of battle, a fire should start on the gun deck, driving the heat and smoke into the engine room, the result would be disastrous.

As a result of these conditions, it was determined to alter the system and provide both supply and exhaust ventilation. This has wrought such a change that the chief engineer now describes the engine room as being comparatively comfortable. In this type of ventilation, blower capacity of supply and exhaust should be equal.

I will not take time to describe any of the systems of combined plenum and vacuum methods of ventilation. Some installations in our public buildings are very complete, combined as they are with direct and indirect methods of heating the air under thermostatic control. Suffice to say that, if such an installation has any place in a habitation on shore, how much more necessary may this method be afloat, when we consider the ship in the light of workshop and habitation combined. Only lack of space can hold back its development. Just as our lungs need supply and exhaust air currents for ventilation of the alveoli, so a ship needs supply and exhaust aids for the ventilation of its compartments. As the man stifles under intense heat and humidity, so must the personnel of the ship. As the man is exhilarated by a cooler, drier air, so is a ship's personnel exhilarated and shielded from exhausting influences.

I am convinced we are headed toward a solution of these problems in all navies, for our peculiar problem is only for ships, and of all ships, the dreadnought, and of all conditions battle conditions. To improve the conditions that are demanded to make a modern dreadnought habitable certain things should be carefully considered.

First. Natural channels of ventilation.

Second. Aids to natural supply and aids to natural exhaust.

Third. The air for artificial supply should come from a pure source in the open air. It should never be drawn from any interior space. It should not be supplied by a ventilator placed abaft a fireroom hatch, blanked in front by a bridge and on the sides by a nest of boats. It should be as free as possible from chances of contamination by the gases of gunfire.

Fourth. Supply and exhaust ventilators should be provided with a method of filtering the water of shipped seas. A French constructor has designed such a ventilator.

Fifth. The supply should be beyond the demands of CO_2 dilution and with a view to reducing heat and humidity. Humidity is the most exhausting factor with which we have to deal.

Sixth. All possible efforts should be directed toward the reduction of heat. Electric galleys, electrically driven ice machines, electric anchor motors, electric steering motors, if these things can be developed, will eliminate the steam pipes, the most potent factors in the overheating of the ship's living spaces.

WEDNESDAY MORNING, SEPTEMBER 25, 1912.

THE RESTRICTION OF MALARIA IN ITALY.

Prof. ANGELO CELLI, University of Rome, Italy.

The struggle against malaria which was begun during the last years of the past century in Italy, started from the Agro Romano, and, beginning with this classical land, I shall attempt to tell what has been accomplished through the initiative and impulse of the Società per gli studi della Malaria.[1]

MALARIA AND THE COLONIZATION OF THE AGRO ROMANO.

Archaeology, as well as history, have established beyond doubt the fact that the Roman Campagna was never all cultivated or colonized. Both hills and plains are to-day, as they were in the more ancient times, kept for pastures or shrubbery or forest, where they are not adapted to intensive agricultural exploitation on account of the dryness and sterility of the earth during summer, and oftentimes during winter, too, owing to the enchanting weather. Agriculture and colonization, however, were in the ancient times, as they are now in modern times, very flourishing nearby the city, about the consular routes, and wherever the plains and the valleys reach humus and water. The agricultural splendor was greatest during the four great periods of past civilization; that is, during the Etruscan and Volscian periods, as well as during the Roman domination, and later on in the eighth and ninth centuries and during modern times between 1600 and 1750. But this flourishing condition did not last after those periods. Why? Historians, as well as other scientists, throw the blame of it on political as well as on economic circumstances, and particularly on wars and so-called barbaric and Saracenic invasions, on the feudal systems and civil wars; but all these conditions here, as elsewhere, never had a stable character, so that, though they might have constituted a temporary delay, they never could have stopped the development of the land or permanently hindered the agricultural progress around a great center of civilization like Rome. It is a ridiculous

though often repeated accusation against the Popes that they created and maintained a desert around Rome, so that the glory of St. Peter's would be the more effulgent in comparison. It is historically proved instead that from Zaccaria I to Pius IX the Popes repeatedly and earnestly attempted to defeat the fate that seemed to dominate the Roman Campagna. Many writers place the blame on the excessive accumulation of wealth and land in the hands of a few, but this deplorable effect of caste never prevented the exploitation of the soil, which has often been attempted by many of the signorie, but without success.

The key to the study of the colonization of the Roman Campagna is to be found, not in such small things as human events, but in something beyond human control, obstinately averse to man; that is, in malaria.

It is well known that, since the last century, modern microbiology has found the cause of malaria in the humble but terrible world of the protozoa and insects.

Thus reduced to a mere biological phenomenon, it was noticed that malaria, like any other great or small manifestation of life, has to-day (as it always had during past centuries) years, months, and even single days of alternate attenuations and recrudescences. It was during the happy periods of attenuation, in coincidence with each of the great epochs of civilization, that the most fertile places of the Roman Campagna were repopulated and intensely cultivated to nourish and enrich the city, but after each period of attenuation there followed a corresponding period of recrudescence during which malaria, implacable against life and health, swept away men and domestic animals as well, thus crippling any further effort toward agricultural improvement.

The observer can not help being struck by the tremendous change brought about during the last few years of the past century in the conditions of the Roman Campagna within a radius of 10 kilometers around Rome, where, among the ruins of many centuries of past civilization, we see growing newly inhabited centers, factories, etc. This fifth epoch of civilization will not, like the preceding four, be swept away, since "nunc licet habitare salubribus," in the open Campagna. The twentieth century has demonstrated the fact that it is possible to colonize, without human victims and without any loss of domestic animals, all the malarial lands throughout the world.

To grasp this new fact, all the scientific researches, as well as the practical experiments, were conducted in a small and limited scale on a farm called Cervelletta.

AT THE CERVELLETTA.

Scientists, as well as landowners, know, at least by fame, this name memorable in the history of malaria. Those who now come to admire

can not well conceive how horrible was this place previous to 1895. The ancient castle, built in 1628 by Cardinal Borghese on the ruins of the medieval tower, was itself in ruins. The dairies had been destroyed and the valleys all around transformed into pestiferous swamps. The only inhabitant was a decrepit guard in charge of a few wild cows. The railway station of Cervara and the residences of the railway guards, which are stationed half a mile apart throughout the length of the Roma Tivoli Line, constituted a malarial hospital and graveyard when, in 1895, some farmers from Lombardy had the courage, which was then called madness, to come and attempt to colonize the place.

In the following summer of 1896 human malaria almost destroyed the small group of men, and in the autumn of the same year bovine malaria killed all the stock imported from Lombardy. We knew from the Americans, Smith and Kilborne, that such disasters as this could be avoided by keeping the stock indoors during the warm season when the ticks (*Ripicephalus annulatus s. Boophilus bovis*) infected them by biting them. This I advised the farmers to do, and when they did so none of the stock died, while on the surrounding farms, where this prophylactic measure was not yet applied, the stock kept on dying. Human malaria also continued to be as prevalent as ever. In 1898 every one was ill with it, and a great many very obstinately so, although quinine was generously distributed and administered. In May, 1908, after long and intelligent researches, R. Ross demonstrated first, and, soon after, Grassi, Bastianelli, and Bignami confirmed, the marvelous anophelic theory, which was immediately put to practical test and control in our camp for the experimental study of malaria at Cervelletta. But we instantly saw how barren of practical results was its crude application, for the destruction of mosquitoes, which we tried in many ways, was not possible in the Campagna. The hydraulic reclamation of the land, although perfectly executed, always left even there amongst the inevitable swamp flora of the little channels, enough Anopheles to prevent the extinction of the pest. The intensive agricultural work conducted under the torrid sun made careful use of the water for irrigation purposes, but such water, although very well distributed, contributed to maintain the Anopheles, whose destruction, already theoretically difficult, was made an impossible task to require of the farmer, who was more preoccupied with the easier income to be derived from his crops. Happily, we found that, without touching the Anopheles themselves, we could get the most splendid results from agriculture in conjunction with perfect sanitary conditions.

After two years of experiments in an endeavor to prevent the anopheles from biting men, we found that the protection of the uncovered parts of the body by masks, gloves, and other apparel

was very difficult to effect on the part of railway employees and farmers. Even the mechanical protection of the houses, placed at the windows and doors, was too expensive and of little practical use. We had to abandon all these means of protection, which naturally came from the application of the anophelic theory, and had to attack the enemy from another point; that is, we tried to kill the malarial parasites in the blood of men by using the old specific, quinine, to prevent as well as to treat the malarial infection. To accomplish this purpose, we had to eliminate all the inconveniences attendant upon the use of the drug by studying its mechanism of action; while, with the light of the new anophelic theory, we had to study anew the epidemiology of malaria, and both the new and the old means of fighting the disease. To enable us to do this, we established throughout Italy, on the same basis as that at Cervelletta, many stations for the study of malaria.

STATIONS FOR THE STUDY OF MALARIA.

Outside of Italy (Holland, Russia, Algeria, Hungary, Greece, and Bulgaria), many such stations have grown up, and from the work of all these places has come a world of scientific and practical information which can be summarized as follows:

There are several indices for measuring a malarial epidemic; such as virulence, mortality, morbidity of all or even a part of the population (such as school children, soldiers, railway employees, miners, farmers, etc.), recidivity, domestic epidemics, infantile mortality (so-called megalosplenic index), relative proportion of estival and primaverile tertian. This last one is in itself the most exact measuring index of malarial epidemics from year to year.

Besides the virulence, one must distinguish the diffusibility of the malarial parasites. Malarial Italy can be thus divided into three zones: One along the Tyrrhenian (Tirreno) and Ionian shores, where there is a maximum of diffusion and virulence of estivo-autumnal parasites (improperly called "tropical parasites"); the second, in the low Veneto, the Maremma Toscana, in the southern province of Italy, and in the islands of Sardinia and Sicily, with a prevailing number of parasites of the primaverile tertian; the third, in north Italy along the Adriatic shore, with an absolute prevalence of the primaverile tertian parasites.

Recidivity is essentially a problem both for epidemiology and for prophylaxis. We have not yet found an easy and rapid etiological means for the diagnosis of the latent and recidive malaria. Dr. Caccini studied the causes of recidivity, and established the laws that regulate them both at long and short intervals. He found, moreover, that relapses are preceded by slight elevation of temperature, which is followed by the attack, during which the fever may be slight or

even absent, and which is in turn followed by anemia, the anemia being greatest in the estivo-autumnal tertian and in quartan. Furthermore, he found that the carriers of latent infection, that is, with parasites in the circulating blood and without clinical manifestation, are to be found, not only among children, but among boys and adults also, and that, in spite of the most accurate treatment, children relapsed in the proportion of 38 per cent, and adults and boys in the proportion of 51 to 52 per cent, thus making the interesting point that extreme youth is not a predisposing element to recidivity when specific treatment is actively carried on. He also found that the parasites of quartan fever, more than those of primaverile tertian, and the latter more than those of the estivo-autumnal tertian, vary in recidivity according to places and different years. Where and when this is grave, there is a preepidemic recrudescence, and it may produce a periodic recrudescence of recidivity.

Infection of anopheles may sometimes be brought about easily, at other times with very great difficulty. We must yet more thoroughly study the conditions which contribute to facilitate or to prevent the infection of the anopheles; such conditions depending upon the anopheles, upon the gametes, and upon the surroundings. That is one of the most essential points for the epidemiology and prophylaxis of malaria.

As to the relation between the diffusion of anopheles and malarial epidemics, it has been soundly proved that, wherever there are malarial fevers, there are always the anopheles, although their number is not always in direct ratio, but rather in inverse ratio, to the epidemic.

It has been found besides that, in warm climates, paludism and anophelism exist without malaria, even when malarial people come from abroad, or there is an occasional autochthonous or sporadic case of malaria. In the same way paludism and anophelism may exist even where and when malaria declines or disappears. Thus certain places, particularly swampy and anophelic, such as rice plantations, are not an obstacle to the progressive diminution and disappearance of malaria. The same can be said of any irrigated section. On the contrary, however, forests and thickets in low and swampy land contribute to breed and diffuse malaria by sheltering the anopheles. In such cases, the cutting of woodland is the first step toward the reclamation of a territory. The putrid waters resulting from the manufacture of hemp and linen, by killing the larvæ of the anopheles, are a source of benefit rather than of disease. Intensive agricultural work and colonization cause a gradual retrogression and disappearance of malaria. The relation between malaria and the seasons is not yet fully explained. It is certainly true that we have an annual epidemic cycle, or a seasonal cycle, which *a potiori*

may be called "estival-autumnal" for the grave tertian, "primaverile" for the light tertian, "autumnal" for the quartan, and, according to the prevalence of the grave or light tertian, we have an annual epidemic type that may be called "South Italian," "North Italian," and "north European." In Hungary, Greece, Bulgaria, and Russia there are the same types, and in Italy, wherever malaria undergoes its attenuation period, the North Italian type gains a foothold.

Besides the annual epidemic cycle, there is a periodic epidemic cycle, with the same attenuations and recrudescences, which a study of the history of the Roman Campagna has established, and which we can follow in the study of the history of any other part of Italy.

Quinine has been very extensively used, but only to break the fever, not to cure the infection, and much less as a preventive. Many inconveniences have limited the use of the remedy. The bitter taste and the impression that quinine would have no effect unless dissolved in water, brought about the use of quinine with acids like sulphuric acid, making it very irritating to the gastro-intestinal membrane. The bad preparations under the various forms of bitter waters, powders, and ill-tasting liquors, all contributed obstacles to the use of the drug for the purpose of eradicating infection. Moreover, the frequency of relapses, on account of imperfect and short use of the remedy, contributed to diminish faith in it, and this prejudice was intensified by attributing to its use all the consequences of malaria (anemia, splenomegaly, hepatomegaly), so say nothing of the discomforts really attributable to the drug, its high price, for instance.

We began at the Cervelletta, and later at the other stations, to eliminate these various inconveniences. We commenced by using those preparations of quinine that are less bitter (euchinine), or not at all bitter (tannate). These and other common salts we combined with sugar and distributed under forms of candies and confections, and, while Prof. Gaglio and his fellow workers of the School of Pharmacology thoroughly studied the mechanism of the absorption of quinine, we demonstrated that—

1. The administration of quinine in palatable form is a good guarantee of its absorption.

2. Hydrate and anhydre quinine, or insoluble compounds, are as well absorbed as the most soluble salts of the alkaloids.

3. Quinine is absorbed through a true process of digestion; that is, it is in small part combined with the hydrochloric acid of the stomach, and in greater part with the biliary acids and with the carbonic acid of the gastro-intestinal tube.

4. The presence of food in the stomach is not of great importance, regarding the absorption of quinine.

5. Quinine, if daily administered, is better tolerated, and for a longer time, if taken in medium doses of 30 or 40 centigrams, so that after a few days it does not even disturb the hearing, is perfectly innocuous, and may serve as a factor of economy on the nutritive principles and as a tonic on the digestive and muscular system. It generates appetite and energy for work.

6. Quinine, taken daily, accumulates in the blood up to about the double of the initial dose, and that this accumulation avoids, rather than induces, the poisonous phenomena. There is, perhaps, no other such good example of adaptation to a remedy. Quinine may be thus taken for a long time (five or six months) in daily doses, and it can be interrupted without inconvenience, without the organism losing its tolerance, and at the same time without the drug losing its therapeutic efficiency.

7. The elimination of quinine through the kidneys, no matter what its compound or the form of administration may be, never lasts more than three days.

8. If quinine be given at intervals longer than three days, the inconveniences arising from the drug appear each time, hence the method of intermittent administration (4–7–10 days) recommended by Koch and others, had to give place to the method of daily administration.

9. The preparations least soluble in water are best tolerated by the gastro-intestinal tube and the nervous system, because they are more slowly absorbed on account of the digestive mechanism above explained.

10. Hypodermic administration is better, if practiced with a neutral solution (ethyl-uretan) and greatly diluted, otherwise the absorption is slower than when the drug is given by mouth.

11. The organotrophic action of quinine, even in the most sensitive and idiosyncratic individuals, as well as in the hemoglobinuric ones, is greatly reduced or annulled when it is combined with tannic acid or with lipoids, such as lecithin or cholesterin.

12. The parasiticidal action of quinine is, "cæteris paribus," in inverse proportion to the degree of development of the parasite in the blood; that is, maximum against the sporozoita, less against the forms which insure recidivity, and null, or almost so, against the gametes.

13. Those who take quinine daily, having a certain quantity of it in the circulating blood, can fearlessly subject themselves to the inoculation of blood loaded with the hemosporidia, and, with much less danger, to the biting of infected anopheles.

14. The resistance, which is opposed to the action of quinine, by the parasite which causes the relapse and by the gametes varies ac-

cording to individual and general conditions which have not yet been well determined.

15. Neither arsenic nor iron can add efficacy to the action of quinine against the gametes and the forms of recidivity. To bring about a more complete sterilization of malarial blood it is the part of wisdom to look for new therapeutic preparations, while, in the meantime, a larger and longer use is made of the most palatable preparations.

Thus enabled to better appreciate the value of the drug, to measure its strength, and to eliminate its inconveniences, since 1900 we have been able to make a better and more general use of it at the Cervelletta as well as the other stations.

So "Provando e riprovando," we found that quinine treatment alone for feverish and recidive malarious patients, no matter how conducted or how prolonged, would not, as Koch maintained, eradicate malaria from a vast expanse of infected country. Lacking a method of easy and rapid diagnosis of latent infection, a great many carriers escaped our attention. Likewise, lacking a simple method for complete sterilization of the blood, many recidives persisted obstinately. Consequently up to this time, even after a continuous and intense treatment throughout the winter and spring, we were not successful in preventing the epidemic the following summer and autumn. We found that with malaria, as with any other disease, prevention was better than suppression; and the remedy itself, as well as being useful, was easy to handle.

Thus the daily use of quinine by all the inhabitants of the Cervelletta prevented the appearance of the disease in the healthy ones, while the malarious were progressively benefited and ultimately cured by a prolonged use of quinine in increased doses. By this easy, innocuous, agreeable, and cheap means we initiated and kept up, year by year, the reclamation of the Cervelletta. Adults and boys took about two doses per day (40 centigrams), while children took about 20 centigrams. To adults and boys the remedy was administered in pills, while children took it in the form of candies.

It is well to explain that farmers were formerly sheltered in huts of straw; the hydraulic reclamation had just been begun, and, though well executed, could not entirely eliminate the anopheles, since the irrigation maintained the anopheles in abundance. The essential factor which had reclaimed the men of the Cervelletta was the daily use of quinine. The Cervelletta's example was followed throughout the Roman Campagna, and Prof. Gualdi, heading the physicians of the health department of Rome, and Prof. Postempski, heading the physicians of the Red Cross, attempted to diffuse the use of quinine as a preventive rather than as a curative agent. Through the main

experimental channel issuing from the Cervelletta started the newly organized fight against malaria throughout Italy, and from Italy it extended over the world.

SPECIAL LEGISLATION AGAINST MALARIA; LAWS ON STATE QUININE.

Through the efforts of our deputies in Parliament and the members of the Association for the Study of Malaria (Hon. Fortunato, Franchetti, Guicciardini, De Asarta, and Wollemborg) special legislation against malaria was presented to Parliament, the main provisions of which are as follows:

1. *The law of December 23, 1900*, by which was established State control of the sale of quinine. This does not constitute a monopoly. Quinine is manufactured by the Central Military Laboratory of Chemistry and prepared in the form of confitures or put up in vials for hypodermic injections. It is thus sold in every drug store throughout Italian territory, as well as in every salt and tobacco store (the latter being Government monopolies in Italy, where nothing but salt, tobacco, and stamps are sold), the price of sale being such as to bring the remedy within the reach of everyone's purse. The income from sales is sufficient to pay for manufacture and at the same time maintain the low price. It is, moreover, used for rewards and to subsidize those municipalities and benevolent institutions that excel in the fight against malaria.

2. *The law of November 2, 1901*, which established the right of any workman to receive State quinine free of charge from his employer or from the Government physicians. The expenses are usually divided at the end of the year among the employers.

3. *The law of June 22, 1902*, by which quinine is furnished at a much lower price to any Commonwealth, municipality, or benevolent institution, or to any person who desires to distribute the remedy free of charge to workmen.

4. *The law of February 25, 1904, article 3*, which enabled the Commonwealth, municipality, or benevolent institution to distribute quinine and other drugs for the treatment of malaria to the very poor free of charge.

5. *The law of March 19, 1904*, which entitles any workman in a malarial territory to free quinine distributed through the Commonwealth, the municipality, or the Government physicians, and this always at the expense of the employer.

The legislation of February 20, 1907, completed the preceding laws and recognized malaria as an occupational disease. This law puts the employer and employee on much the same footing as the employer's liability law of America; hence the duty on the part of the employer to prevent and to cure it by paying for the quinine which is given to workmen in malarial localities.

In this way the distribution of quinine has become a State function, not as a benevolence or charity, but as a means for preserving the public health. The quinine tax is a characteristic application of the English system; that is, it does not apply to every landowner, but only to those owning land in malarial sections, who pay not in the ratio to the number of workmen they employ (for this could not be determined), but in accordance with their real-estate holdings, even though the land is left uncultivated, thus being condemned to a pecuniary punishment for leaving their estates unimproved.

I will pass over in silence the malevolence and the obstacles which we had to overcome in the application of these laws, and will describe instead the good effects these laws have had on mortality and morbidity due to malaria in Italy.

STATE QUININE IN ITS RELATION TO MORTALITY FROM MALARIA.

In Table I the use of State quinine is compared with mortality from malaria during the period 1900–1911:

TABLE I.—*State quinine and mortality from malaria in Italy.*

Year.	Kilos of quinine sold.	Clear profit in lire.	Mortality from malaria.	
			Year.	Dead.
1900	.....	.....	1900	15,865
1901	.....	.....	1901	13,358
1902–1903	2,242	34,000	1902	9,908
1903–1904	7,234	183,038	1903	8,513
1904–1905	14,071	183,382	1904	8,501
1905–1906	18,712	296,295	1905	7,838
1906–1907	20,723	462,280	1906	4,871
1907–1908	24,351	700,062	1907	4,160
1908–1909	23,635	[a] 769,809	1908	3,463
1909–1910	21,656	[a] 720,000	1909	3,533
1910–1911	22,795	[a] 843,312	1910	3,619

[a] Including profits on quinine exported.

As the private production, as well as the importation and sale, of quinine did not diminish during this period, it is evident that the State system of distribution reached those very people who otherwise could not have had quinine and would have died for the want of it. We may here add that the periodic exacerbations were prevented wholly by the extensive use of the drug, and that such places as the Basilicata and the Sardegna, where the periodic exacerbations were formerly the worst, showed a tremendous improvement, which was not brought about by any hydraulic reclamation of the land or any economic movements. Consequently, beyond doubt, the greatest and most persistent decrease of mortality from malaria in Italy was due to the increased consumption of quinine; therefore conditions lead us to hope and to believe that a united and vigorous effort to still further

increase its consumption and to improve the utilization of this national remedy will constantly diminish the number of fever victims.

STATE QUININE AND MORBIDITY FROM MALARIA.

Having quinine so freely at our disposal, we find it sufficient to almost always prevent the disease. Naturally, we must proportion the quantity of quinine to the virulence and diffusibility of the disease and to the conditions. The quinine prophylaxis must be applied to all the inhabitants; not limited to the infected families only. As to the dose, it must be regulated according to the age of the patient—20 to 60 centigrams for the adults, while to children should be given a dose of from 10 to 30 centigrams. The quinine prophylaxis reduces to the minimum the primitive infection and equally diminishes the recidives. Even though it can not prevent entirely an occasional attack of fever, it does not increase the resistance of the plasmodium to therapeutic doses which are generally sufficient to break the fever.

Where malaria is in the light form, prophylaxis is superfluous. The prolonged use of quinine, case by case, is sufficient. In spite of all the difficulties encountered, this quinine prophylaxis is universally recognized as the only effective means of waging war against malaria, not only in civilized countries like Dalmatia, Istria, Greece, Crete, Bulgaria, Argentina, Brazil, etc., but in undeveloped countries like the French, Dutch, English, and German colonies.

The following table will show the results of observations made among soldiers and marines:

TABLE II.—*Malaria in the army.*

Year.	Number of men.	Attack rate.	Recidivates.	Primitives.	Observations.
		Per cent.	*Per cent.*	*Per ct.*	
1902	199,253	27.44	21.41	6.03	
1903	206,468	24.14	17.85	6.28	Begun quinine prophylaxis.
1904	210,637	19.21	12.71	6.50	Continued quinine prophylaxis.
1905 [a]	218,409	21.52	13.04	8.48	Do.
1906	211,245	18.99	12.67	6.32	Quinine prophylaxis extended.
1907	202,320	12.46	7.96	4.50	Do.
1908	216,679	8.04	5.19	2.85	Do.
1909	228,951	6.96	4.72	2.24	Do.
1910	234,104	5.10	3.23	1.87	Do.
1911	233,517	4.90	3.04	1.86	Do.

[a] Year of periodical recrudescence of the epidemic.

TABLE III.—*Malaria in the hospital of Taranto.*

Year.	New cases.		Observations.
	Total.	Per cent of men.	
1900	193	20.19	
1901	130	13.19	
1902	35	14.64	
1903	81	8.33	Begun quinine prophylaxis.
1904	89	9.65	Do.
1905 [a]	107	10.09	General quinine prophylaxis.
1906	72	7.00	Do.
1907	74	6.75	Do.
1908	46	3.94	Do.
1909	23	1.25	Do.
1910	13	.75	Do.
1911	21	.96	Do.

[a] Year of periodical recrudescence of the epidemic.

From these statistics it is evident that since the prophylaxis began the number of malarial cases has dropped to a minimum. The same is true of the laborers engaged on the gigantic aqueduct for the Puglie, where the cases of malarial fever have now become very rare, though formerly the number of cases was so great the work often had to be stopped for many months in succession. Thus quinine prophylaxis has proved to be a good business proposition for any enterprise or for any company and has grown so much in public favor that it is now deemed obligatory in any private contract.

Among the miners of the Grossetano of Sardinia and Sicily, where formerly malaria was most prevalent, the percentage of cases has dropped to 1.3 per cent, and even as low as 0.67 per cent. Among the agricultural population particularly there is the natural apathy and the old prejudice; therefore, in every agricultural community there are one or more men who, acting under medical direction, are assigned to the distribution of quinine every day throughout the summer or until the warm weather ceases. Certain hours and places are specified in which particular pains are taken to insure that the remedy is actually administered. This was first done at the Cervelletta, the custom afterwards becoming general throughout the Roman Campagna and later on throughout all Italy. I will here mention the farm Stucky of Villa Nova at Portogruaro, and the farm Ponti, which became and still remain real oases of salubrity, situated as they are in the midst of the periodic epidemic recrudescence. I will also mention the farm Rizzolo of Francofonte in Sicily, one of the most beautifully and scientifically organized farms in the world, where, for 30 years, hygienic houses were constructed, properly protected against mosquitoes, and where such houses became of no particular use on account of the negligence of the inhabitants. Here mosquito nettings were even used around the beds and the irrigation waters were treated with kereosene oil, but in spite of all that malaria per-

sisted in the gravest form until the last few years, when quinine prophylaxis has been strictly applied to every inhabitant, causing the disappearance of the disease. This and other examples which I could cite demonstrate the fact that the best hydraulic or agrarian reclamation is far from being successful in the final destruction of malaria, for the disease invariably ends by killing the new settlers in malarious sections.

I will report here a very interesting case which will confirm the efficacy of the quinine prophylaxis. In Castiadas, Sardinia, during the period 1907–1909, daily doses of quinine were distributed during the malarial months to every convict and every guard of the penitentiary. As we will see from Table IV in the years 1904–1906, preceding the establishment of the quinine prophylaxis, malaria attacked from 46 to 92 per cent of the inhabitants, in spite of the best methods of reclamation and in spite of the mechanical protection against mosquitoes. It was the prophylactic administration of quinine alone that produced the miracle of diminishing malaria to 8 or 9 per cent.

In 1910, following the mistaken advice of some of our pathologists and clinicians, they adopted the "human sterilization" method; that is, the administration of quinine during winter and spring to all malarial patients. Hoping thus to eradicate the disease they suspended the quinine administration during summer and autumn. Immediately the proportion of malarial patients grew to 19 per cent. In 1911 they went back to the quinine prophylaxis in daily doses, and the proportion of patients at once went down to 6 per cent, in spite of the recrudescence in the surrounding country.

To conclude, the daily administration of quinine to every inhabitant of a place is sufficient to prevent a malarial epidemic.

TABLE IV.—*Malaria in the penal colony of Castiadas.*

Year.	Population, Dec. 31.	Quinine consumed in kg.	Malarial cases.		Observations.
			Number.	Per cent.	
1904	748	.....	694	92	No quinine distributed.
1905	861	13,674	731	84	Do.
1906	807	15,080	390	48	
1907	795	40,230	132	16	Quinine distributed.
1908	700	35,400	97	13	Do.
1909	691	32,000	64	9	Do.
1910	655	15,280	139	19	Curative quinine.
1911	540	25,360	37	6	Prophylactic quinine.

Quinine prophylaxis is just as effective, if properly used, throughout immense territories, a fact proven by our physicians working in vast malarial sections of Italy, and one of the best instances is that of the Roman Campagna, where the system was introduced by the local board of health and by the Red Cross. Quinine was distributed

generously in the form of confitures and candies for the children. It is impossible to describe all the difficulties encountered among an apathetic and fluctuating population, where the physician and the nurse, horseback or in the ambulance, had to go seeking the patients through the most inhospitable sections.

TABLE V.—*State quinine and malaria in the Agro Romano.*

	1900	1901	1902	1903	1904	1905 [a]	1906	1907	1908	1909	1910
Prophylaxis in the Agro Romano	.....	1,176	3,853	17,506	29,693	38,429	42,726	34,927	33,808	35,800	40,973
Primitive cases treated by the Red Cross:											
Number	1,716	1,263	764	320	162	250	129	166	127	201	187
Per cent	17	16	17	2	1.34	1.52	0.77	1.44	1.92	0.70	2.2
Malarial treated by the Red Cross:											
Number	3,751	2,366	2,581	1,547	1,406	839	576	371	437	470	425
Per cent	31	26	20	11	10	5	3.4	3.2	2	4.2	4.3
Malarial treated at the hospitals at Rome	6,186	4,275	2,750	2,461	2,961	3,991	2,513	2,486	2,748	2,417	1,775

[a] Year of the periodical recrudescence of the epidemic.

Table V shows clearly the effects of the system; since 1903 the percentage of patients has dropped from 19 to below 1, while the total number of patients treated has diminished from 20 to 4.3 and even as low as 2 per cent. In the hospitals of Rome the number of patients diminished from 6,194 in 1900 to 4,276 in 1901, after which they gradually decreased to 1,775, the lowest number ever reached during a period of 20 centuries. Consequently we can say that the simple diffusion, or better, the simple distribution, of quinine has reclaimed and is still reclaiming our country places from the perennial plague—malaria.

LAWS ON HYDRAULIC RECLAMATION.

Swamps generate malaria; consequently to destroy malaria swamps have to be dried. This was believed and was acted upon for centuries, regardless of economy. The good example had been set by the pre-Roman peoples and later on by the Romans themselves. With the Renaissance and during Napoleonic times, as well as after, the Governments of Lombardy and Venice, that of Tuscany, and even the most retrograde, as the Papal and the Bourbonic ones, depleted their treasuries in hydraulic reclamation, following the traditions of Leonardo Da Vinci and Galileo.

During the period from 1862 to 1900 we spent $23,600,000, and between 1900 and 1912 we spent an additional $36,800,000, making altogether $62,400,000. We have already an additional $57,400,000 appropriated for the purpose and another $30,000,000 just recently appropriated by the Parliament. But in spite of all the years and all the millions spent for hydraulic reclamation only a minimum success

in sanitation was obtained as compared with that which during the short period of 10 years has been obtained by the use of State quinine, and that, too, with a large profit.

We can easily understand to-day the reason for the limited advantages which were obtained through hydraulic reclamation, since that very seldom eliminates the anopheles. Moreover, extensive sections of land remained useless even after having been reclaimed, for very little attention was given to making the land remunerative. We are now directing our attention to new laws to make those lands remunerative. (Law of July 7, 1902.) The law of July 19, 1911, provides for the replanting of forests, building of roads, and proper drainage. The special committee on malarial legislation at the Italian Parliament is now preparing a new compilation of all the laws pertaining to malaria, for the purpose of enacting legislation more in accord with recent discoveries and present conditions.

LAWS ON AGRARIAN RECLAMATION AND ON COLONIZATION.

Law of July 8, 1883.—This came when malaria was worst in the Roman Campagna, both among men and animals, and we were still without a clear view of the way to prevent it.

The law of December 13, 1903, was modified by the parliamentary committee on malaria (Hons. Chimirri and Celli) in accordance with the result of the work done at the Cervelletta and with the new discoveries. The advantages gained from this law were mainly as follows:

1. Both the landlord and the lessee were reimbursed to the extent of 30 per cent of any expenses incurred in making improvements that would tend to prevent malaria.

2. Loans were taxed at the rate of 2½ per cent, the tax to be discontinued after 45 years, and the income derived therefrom to be used for the building of roads, replanting of farms, scientific farming, etc.

3. The exemption of these lands from taxation for a period of 10 years.

The Government reserved the right to purchase all land not reclaimed, but it must be said that this provision never had to be applied, which is the best compliment that could be paid to the law.

The law of July 17, 1910, mainly provided for the extension of the zone around Rome beyond the 10-kilometer limit, for facilitating the construction of new centers in the Campagna, and for special agrarian banks which would provide the funds for any improvement a landowner desired to make. It also provided for the creation of a zoologic institute for the study of the causes of and the preventive means for fighting epidemics among animals.

Thus, for the fifth time in the history of the Roman Campagna it is brought back to a civilization which will never again be destroyed.

[1] See Atti della Società per gli studi della Malaria, Vol. I–XII, Roma 1900–1912 e Bullettini 1–24 Roma 1899–1912. . . . L'opera della Società per gli studi della Malaria in *Malaria* Bd. I. Heft I., Leipzig.

DIE BEKÄMPFUNG DER MALARIA.

Marine-Generalarzt Prof. Dr. Reinhold Ruge, in Kiel.

Bei Bekämpfung der Malaria sind alle bekannten Methoden anzuwenden. Je nach den örtlichen Verhältnissen, unter denen die Bekämpfung stattfinden muss, wird man auf die eine oder andere Bekämpfungsart den Hauptwert legen müssen.

Die Massnahmen können sich entweder gegen die Ueberträger der Malariaparasiten, die Anophelinen, oder gegen die Malariaparasiten selbst richten.

Im ersten Falle würde es sich also um den Kampf gegen die Anophelinen und Schutzmassregeln gegen ihre Stiche handeln. Hierzu kann man auch die Assanirung rechnen, die ja schliesslich nichts anderes ist als eine Bekämpfung der Stechmücken im grössten Massstabe und im weiteren Sinne kann hier auch die Beseitigung der Infektionsquellen (d. h. die Eingeborenen und ihre Kinder) durch Absonderung der Europäer-Quartiere von denjenigen der Eingeborenen (Segregation) angeschlossen werden. Für den zweiten Fall kommt nur die Chininprophylaxe in Frage.

1. BEKÄMPFUNG DER ANOPHELINEN.

Ehe man die Bekämpfung der Anophelinen im grossen Massstabe beginnt, wird es sich empfehlen, vorausgesetzt, dass das nöthige ärztliche Personal zur Verfügung steht, die Verbreitung sowie die verschiedenen Arten der Anophelinen und ihre Lebensgewohnheiten festzustellen. Bei der Bekämpfung der Stechmücken kommt vorwiegend die Vernichtung der Mückenlarven in Betracht. Ein Bekämpfen der geflügelten Insekten kann mit Aussicht auf Erfolg nur stattfinden, wenn sie sich in der Überwinterung bzw. in der Überdauerung der tropischen Trockenzeit befinden. In nördlichen Gegenden in denen sie in Ställen, Kellern ect. überwintern, kann man sie durch Ausräucherung mit Pyrethrum oder Ausspritzung mit Giemsa-Lösung vernichten. Wenn ferner in Betracht gezogen wird, dass in einzelnen Tropengegenden z. B. in Sierra Leone (nach Stephens und Christophers) oder (nach Steudel) in Garua

(Kamerun) die Anophelinen während der Trockenzeit nicht nur in den Eingeborenenhütten gefunden, sondern fast in Reinkultur gefunden werden; so dürfte das eben genannte Verfahren auch in manchen tropischen Gegenden Erfolg versprechen.

Bei weitem radikaler und aussichtsvoller ist der Kampf gegen die Mückenlarven.

Es hat sich bei den zahlreichen Versuchen, die in dieser Beziehung gemacht worden sind, allmählich herausgestellt, dass das Vernichten der Larven gar nicht so einfach und unter bestimmten Umständen überhaupt unmöglich ist. Selbst wenn die larvenhaltigen Tümpel mit Petroleum oder Saprol besprengt werden, und diese Besprengung wöchentlich zweimal wiederholt wird, ist es nicht leicht eine zusammenhängende Deckschicht von Petroleum[1] oder Saprol auf der Wasseroberfläche zu erzielen. Ausserdem treibt jeder stärkere Windzug die mühsam hergestellte Petroleumschicht wieder auseinander und man kann also nur an windstillen Tagen die gewünschte Wirkung—Abtöten der Larven—erzielen.

Sind aber die Brutstätten der Anophelinen zu ausgedehnt, erzeugt z. B. jeder Fusstritt des weidenden Rindviehs einen neuen Brutplatz (Gorgas), dann wird man von vorneherein von einer Petrolisirung Abstand nehmen. Aber auch da, wo die Bruttümpel der Anophelinen zugleich das Trinkwasser für die Bevölkerung liefern, wird von einer Petrolisirung nicht die Rede sein können. Das ist z. B. in Nordholland der Fall, wo die Brutstätten der Anophelinen zugleich Viehtränken sind. Wurden solche Tümpel mit Petroleum begossen und soff das Vieh von solchem Wasser, so schmeckte die Milch solcher Kühe nach Petroleum (Schoo).

Zum Glück ist in dieser Beziehung durch das Entdecken von natürlichen Mückenlarvenfeinden ein Fortschritt gemacht worden. Als die weitverbreitetsten Mückenlarvenfeinde haben sich die Notonecten erwiesen und es ist zu erhoffen, dass durch Einsetzen dieser Tiere in Anophelinenbrutstätten, die wirtschaftlich unentbehrlich sind und daher nicht mit Petroleum behandelt werden können, die Larven vernichtet werden können.

Auch unter den kleinen Fischen gibt es eine Reihe von Mückenlarvenfeinden. Ein besonders gieriger Larvenjäger ist der Giardinus poeciloides, der namentlich auf der Insel Barbados in Massen auftritt. (Seine Schwärme werden dort als "millions" bezeichnet.) Ihm verdankt wahrscheinlich die genannte Insel ihre Malariafreiheit. Man hat versucht diese Fischart und ähnliche z. B. das australische Blauauge (Pseudomugil signifer) in Malariagegenden einzuführen und hoffte durch sie die Mückenlarven entsprechend reduzieren zu können. Die erhofften Resultate sind aber meistens ausgeblieben, wenn die Einführung der Fische überhaupt gelang. Man kann aber

die Mückenlarven mit besserer Aussicht auf Erfolg in anderer Weise bekämpfen. Es müssen aus den als Brutstätten dienenden Wasseransammlungen und Gräben alle Wasserpflanzen entfernt und die Ränder glatt abgestochen werden. Auf diese Weise werden den Larven ihre Schlupfwinkel entzogen. Auch muss dafür gesorgt werden, dass das Wasser der gereinigten Gräben in Fluss kommt. Denn in fliessendem Wasser können sich die Anophelinenlarven nicht halten. Eine Ausnahme in dieser Beziehung machen nur die Larven von Nyssorhynchus willmori, die sich auch in Gräben halten, die von Pflanzenwuchs befreit sind und selbst durch tropische Regen nicht ausgewaschen werden können. In einem solchen Falle hilft nur Untergrunddrainage (Watson).

Besondere Schwierigkeiten können entstehen, wenn grosse Bewässerungsanlagen zu Anophelinenbrutstätten geworden sind. Das ist, z. B. in Nord-Holland mit den das Land durchziehenden Kanälen der Fall. Beseitigt können diese Kanäle nicht werden, weil sie der Schiffahrt dienen. Das Einleiten von Seewasser tötete zwar die Anophelinenlarven, beeinträchtigte den Graswuchs in der nächsten Umgebung aber derartig, dass die Kühe nicht mehr genügend Milch gaben (Schoo). Ähnliche Schwierigkeiten finden sich in Punjab, Indien. Hier sind die Baewässerungsanlagen, ohne die das Land zur Wüste werden würde, zu Anophelinenbrutstätten geworden. Bemerkenswert aber ist, dass es hier weniger die eigentlichen Bewässerungsgräben sind, in denen die Anophelinen brüten, als vielmehr die durch Lekagen entstandenen Pfützen und Tümpel (Giles).

Überhaupt hat man sehr bald erkannt, dass die künstlich, und absichtlich von Menschen geschaffenen Brutplätze (Wassertanks, Springbrunnen, schlecht angelegte Drainagegräben, Gräben entlang den Eisenbahnen u. s. w.) unter Umständen vielmehr als die natürlichen Wasseransammlungen als Brutplätze in Betracht kommen. Namentlich ist darauf Bedacht zu nehmen, dass in unmittelbarer Nähe der Wohnungen alle als Brutplätze dienenden Wasseransammlungen beseitigt werden. Arbeiten, die diesen Zwecken dienen, werden am besten durch die von Ross eingeführten Moskitobrigaden verrichtet. Die Erfolge der Mückenlarven-Bekämpfung sind je nach Klima und begleitenden Nebenumständen sehr verschieden gewesen. Sind aber die natürlichen Brutstätten zu ausgedehnt, als dass sie mit Petroleum behandelt werden könnten, so wird es notwendig, den Boden trocken zu legen und zu drainiren, kurz dasjenige Verfahren anzuwenden, das wir als Assanirung bezeichnen. Da aber dieses Verfahren unter Umständen zu hohe Kosten verursacht und daher nicht überall angewendet werden kann, wird an manchen Plätzen nichts anderes übrig bleiben als zur Chinin- und mechanischen Prophylaxe zu greifen.

Es ist ja von vornherein klar, dass man der Malaria durch die mechanische Prophylaxe allein nicht Herr werden kann, sie ist aber trotzdem ein ausserordentlich witchtiger Faktor in der Malariabekämpfung. Es handelt sich hierbei um Eindrahtung ganzer Häuser oder Schiffe oder deren Teile sowie um Anwendung von Moskitonetzen, Tragen von hochschäftigen Stiefeln zum Schutz der Knöchel- und von leichten Halstüchern zum Schutz der Nackengegend.

Mit Eindrahtung sind überall da, wo es sich darum handelte, solid gebaute Häuser einzudrahten oder da, wo die Häuser von vorneherein unter Berücksichtigung der Eindrahtung gebaut wurden, gute Resultate erzielt worden. In anderen Fällen aber, wo man versuchte bereits fertig gebaute Häuser, z. B. Bungalows mit Drahtschutz zu versehen, erreichte man den gewünschten Erfolg nicht immer, da die Anophelinen nicht nur durch die Fenster und Türen, sondern auch durch zahlreiche andere Öffnungen in solche wenig solid gebaute Häuser eindringen können. Dazu kommt, dass die Häuser, die nicht von vorneherein mit Rücksicht auf Drahtschutz gebaut sind, beim nachträglichen Anbringen von Drahtschutz zu heiss werden. Auch sind die Kosten der Eindrahtung nicht ganz unbedeutend, weil nur Messingdraht oder Phosphorbroncenetze benutzt werden können. Der einzelne Europäer wird sich stets durch ein Moskitonetz oder durch ein moskitosicheres Zelt zuschützen suchen, wie solche von Zupitza und Fülleborn angegeben worden sind. Allerdings macht ein solches moskitosicheres Zelt beim Transport allein drei Trägerlasten aus.

Auch auf Schiffen hat man sich nicht nur durch einzelne Moskitonetze, sondern auch durch Mückensichermachen ganzer Räume zu schützen versucht. Poech hat schon vor 10 Jahren damit angefangen und jetzt sind die deutschen Kriegsschiffe, die durch ihren Dienst, z. B. Vermessungs arbeiten gezwungen sind, Monate und jahrelang in Malariagegenden zu verweilen, mit teilweisen Moskitoschutz versehen. Am weitesten ist in dieser Weise die Liverpooler Booth-Line fortgeschritten, die seit 1½ Jahren auf dem Amazonen-Strom Dampfer laufen lässt, die mit Ausnahme der Kombüse und der Maschinenräume [1] mückensicher durch Phosphorbronzenetze eingedrahtet sind. Von den 8,000 Angestellten dieser Dampfergesellschaft erkrankten während dieser Zeit angeblich nur ein Mann an Malaria und keiner an Gelbfieber, obgleich die Dampfer regelmässig den wegen seiner schweren Fieber berüchtigten Hafen von Porto Velho am Rio Madeira anlaufen.

Einen weiteren Schutz für Europäer gewährt schliesslich die Absonderung der Europaerquartire von denen der Eingeborenen (Segregation). Auf diese Art wird die Infektionsquelle (Eingeborene und deren Kinder) vom Europäer ferngehalten. Die

Entfernung der beiden Quartire von einander wird von lokalen Verhältnissen abhängig sein. Doch würde es sich empfehlen die Entfernung nicht unter 1,000 zu bemessen.

2. DIE CHININPROPHYLAXE.

Die Chininprophylaxe hat zwar die in sie gesetzten Hoffnungen nicht vollständig erfüllt. Denn es hat sich herausgestellt, dass wir nicht im Stande sind, durch irgend eine Art von Chininprophylaxe eine Erkrankung an Malaria mit absoluter Sicherheit zu verhindern. Das darf aber kein Grund sein, die Chininprophylaxe überhaupt für nutzlos zu erklären.[2] Allerdings darf nicht vergessen werden, dass der Erfolg der Chininprophylaxe abhängig ist von dem guten Willen aller Beteiligten. Es kommt also Alles darauf an, eine Prophylaxen-Art ausfindig zu machen, deren Nebenerscheinungen nicht der Art sind, dass sie den Widerstand der Prophylaktiker herausfordert und somit den Erfolg der Prophylaxe in Frage stellt. Hierin liegt eine der Hauptschwierigkeiten für die Chininprophylaxe.

Aus diesem Grunde ist die doppelte Grammprophylaxe, das heisst das Verabfolgen von je 1.0 g Chinin an zwei aufeinanderfolgenden Tagen (z. B. am 6. und 7. Tag) aufzugeben. Denn die unangenehmen Nebenwirkungen namentlich am zweiten Chinintage sind derartig, dass die Prophylatiker, z. T. arbeits- oder dienstunfähig werden.

Ob es sich empfiehlt, die Ziemann'sche Prophylaxe (d. h. jeden 4. Tag Chinin 1.0 g oder eine andere Art der Prophylaxe zu wählen z. B. jeden 4. und 5. Tag Chinin je 0.5 oder ob täglich kleine Dosen von 0.3–0.4 g Chinin genommen werden sollen, lässt sich allgemein nicht festsetzen. Man muss vielmehr mit der Chininprophylaxe regionär differenzieren und sobald trotz Chininprophylaxe doch Fieber auftritt, sofort mit der Prophylaxe aufhören, um mit der Behandlung anzufangen.

Auch wird man stets in Betracht ziehen müssen, dass die Chininprophylaxe namentlich für das einzelne Individium und für Leute in Betracht kommt, die unter ärztlicher Controlle stehen, z. B. Truppen, dass aber die Chininisierung einer freien Bevölkerung immer auf mehr oder minder grosse Schwierigkeiten stossen wird, und dass daher die dabei erzielten Erfolge nie als ausschlaggebend für die Beurtheilung der Leistungsfähigkeit der Chininprophylaxe angesehen werden dürfen.

Ob es möglich sein wird, mit dem in jüngster Zeit von Werner vorgeschlagenem, geschmacklosem Chininpräparat, Insipin, oder mit dem von Marshall empfohlenen und gleichfalls geschmacklosen Alkaloid der Samen von Peganum harmala, dem Harmalin, bessere Erfolge zu erzielen, bleibt abzuwarten.

Jedenfalls ist ausser den eben erläuterten, im Kampfe gegen die Malaria anzuwendenden Mitteln stets noch eine ausgiebige Belehrung der Bevölkerung—und zwar schon in der Schule—über das Wesen und die Übertragungsweise der Malaria mit allen zu Gebote stehenden Mitteln durchzu führen.

[1] Es muss für die Besprengung der Tümpel nur Rohpetroleum ausgegeben werden, damit es nicht zu Beleuchtungszwecken benutzt wird.

[2] Die Eindrahtung dieser Räume ist nut solange nötig, als sie ausser Betrieb sind, da die Mücken bei Temperaturen von 38° C., die während des Betriebes herrschen, verschwinden.

[3] Auch der Umstand, dass wir es manchmal mit chininfesten Stämmen von Malariaparasiten zu tun haben, ist kein Grund für ein Aufgeben der Chininprophylaxe.

RAPPORT SUR LA LUTTE CONTRE LE PALUDISME.

EDMOND SERGENT, Alger.

Une campagne antipaludique doit débuter par l'étude des conditions locales du paludisme que l'on aura à combattre. En partant de ce fait que le paludisme est une maladie commune à l'homme et aux moustiques, on peut considérer dans cette étude épidémiologique les trois points suivants:

1°. *Les gîtes à Anophélines.*—Reliefs et contours du sol de la localité, nature du sous-sol, eaux, météorologie locale, flore et faune terrestres et aquatiques, Anophélines présents (détermination, biologie, pourcentage des infectés).

2°. *Réservoir de virus* (*anciens infectés*).—Index endémique: plasmodique, et splénique, du réservoir de virus sédentaire et des émigrants. Données cliniques: perniciosité, récidivité des cas. Rapports entre la tierce maligne, la bénigne et la quarte. Fièvre bilieuse hémoglobinurique. Si possible, statistiques (au moins hospitalières). Etude des plasmodium; formules leucocytaires; altérations du sang.

3°. *Les sujets exposés* (*nouveau-nés*, *nouveau-venus*).—Importance numérique, importance économique, mode d'existence, répartition géographique. Etude des conditions de résistance à l'infection.

Question des réinfections des anciens paludéens guéris.

Ces données préalables sont figurées sur des cartes géographiques, dans les tableaux, des diagrammes et des schémas. Ainsi se constitue l'exploration méthodique du champ d'activité et sont fixés les points de comparaison qui serviront à l'évaluation des résultats de la campagne antipaludique.

Après l'étude préliminaire du paludisme local, on passe à la mise en pratique des mesures prophylactiques dont le principe se résume

dans cette double proposition: Empêcher le moustique d'infecter l'homme; empêcher l'homme d'infecter le moustique.

Suivant qu'on envisage la question sous l'une ou l'autre face, on aboutit à des procédés antipaludiques très variés que l'on peut classer ainsi:

A) *Eloignement des gîtes.*—Choix de l'habitation ou du campement sur une hauteur, à bonne distance des collections d'eau, des bords d'étangs ou de rivière.

B) *Eloignement du réservoir de virus.*—Choix de l'habitation ou du campement à bonne distance des agglomérations d'anciens infectés, principalement des indigènes.

C) *Grandes mesures antilarvaires.*—Ce sont celles qui relèvent de l'art de l'ingénieur (hydraulique agricole, etc.).

D) *Petites mesures antilarvaires.*—Ce sont celles qui, à très peu de frais, et avec une main d'œuvre très restreinte, s'attaquent directement aux gîtes pour les maintenir indemnes de larves.

Les petites mesures antilarvaires sont: D'ordre biologique (faucardement des herbes, pétrolage des surfaces d'eau, introduction de poissons etc.); d'ordre mécanique (comblement des mares, leur bloquage, leur vidage, leur drainage). Une mesure excellente que nous appliquons en Algérie dans les gîtes si fréquents formés par les canaux d'irrigation, ou d'écoulement des fontaines, consiste à assurer l'intermittence de l'arrivée de l'eau dans ces gîtes. Dans l'intervalle de deux arrivées d'eau, intervalle qui doit être inférieur à la durée moyenne de la vie larvaire in loco, le gite se déssèche et les larves meurent. Pour arriver à ce but, il suffit d'avoir deux canalisations qui fonctionnent tour à tour; une vanne à baisser ou à lever chaque semaine. On peut arriver au même résultat en déversant alternativement toutes les semaines une eau d'écoulement de part et d'autre de son canal, par le moyen de barrages de dérivation provisoires. De cette façon le lit du canal en aval est toujours à sec et les mares produites se déssèchent chaque semaine. En résumé, l'intermittence de l'arrivée d'eau dans les gîtes peut être assurée, soit par les doubles canaux, soit par les barrages alternatifs.

E) *Mesures de destruction des adultes.*—Trous-pièges; nasses; anhydride sulfureux; poudre de pyrètre.

F) *Quininisation préventive* (petites doses journalières, ou grosses doses à intervalles de plusieurs jours).

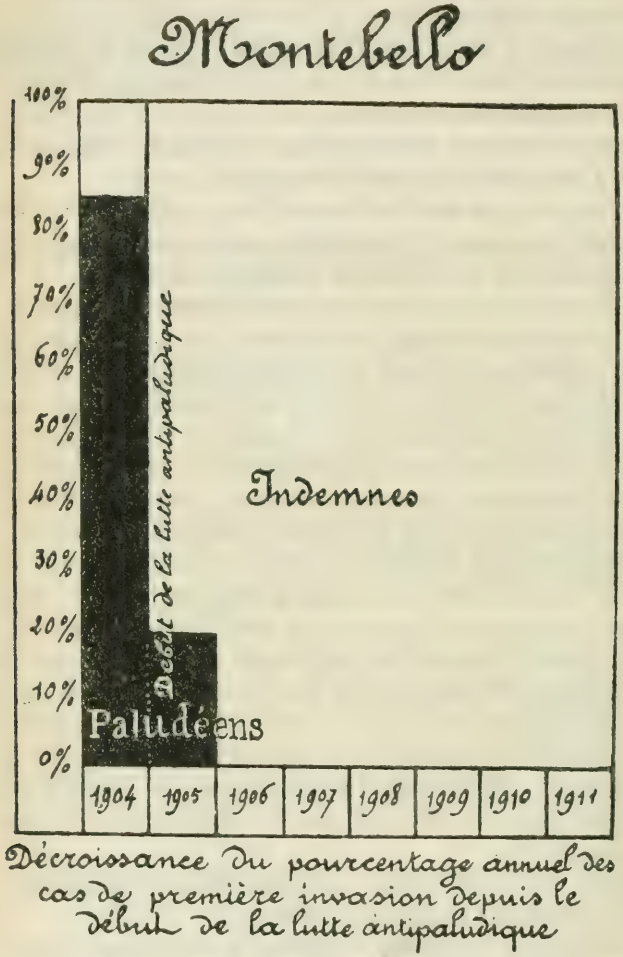
G) *Quininisation curative* (traitement des accès, puis quininisation continue par petites doses journalières ou par fortes doses à intervalles de plusieurs jours).

H) *Défense mécanique individuelle* (moustiquaire de lit).

I) *Défense mécanique collective* (grillage de toutes les ouvertures des habitations).

Parmi toutes ces techniques, les préférences des malariologues vont à celles que permettent les conditions du milieu où ils agissent.

Autrefois les grandes mesures antilarvaires (C) étaient considérées comme les plus efficaces, et pendant longtemps on a appliqué la même expression d'assainissement d'une région à son assainissement agricole et à son assainissement antipaludique. On voit aujourd'hui

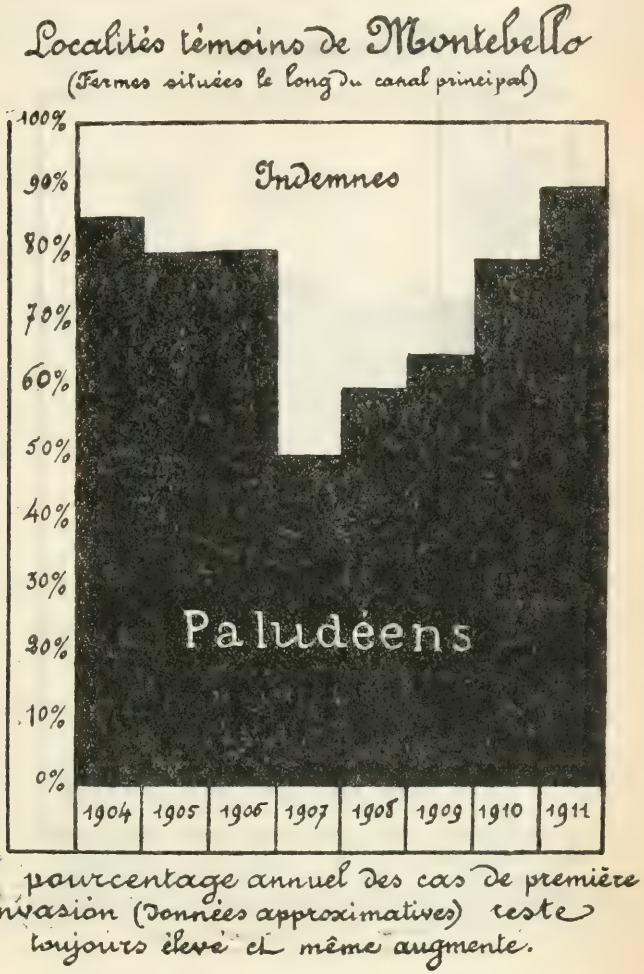


que l'amélioration agricole d'une terre par les drainages, les canaux de desséchement et toutes les œuvres d'hydraulique n'ont pas d'effet direct sur le paludisme. Les canaux de desséchement sont des gîtes comme les marais qu'ils remplacent, mais ce sont des gîtes réduits et plus accessibles. D'autre part la culture agit indirectement contre le paludisme par la mise en valeur des sols improductifs, car l'enrichissement des populations leur donne le goût du bien-être, dans l'habi-

tation, dans l'alimentation et dans le vêtement, et leur résistance aux maladies s'en trouve accrue.

A l'heure actuelle deux tendances se font jour parmi les malariologues:

Les uns, à la suite de R. Ross, préconisent surtout l'emploi des petites mesures antilarvaires (D); les autres, au premier rang des-

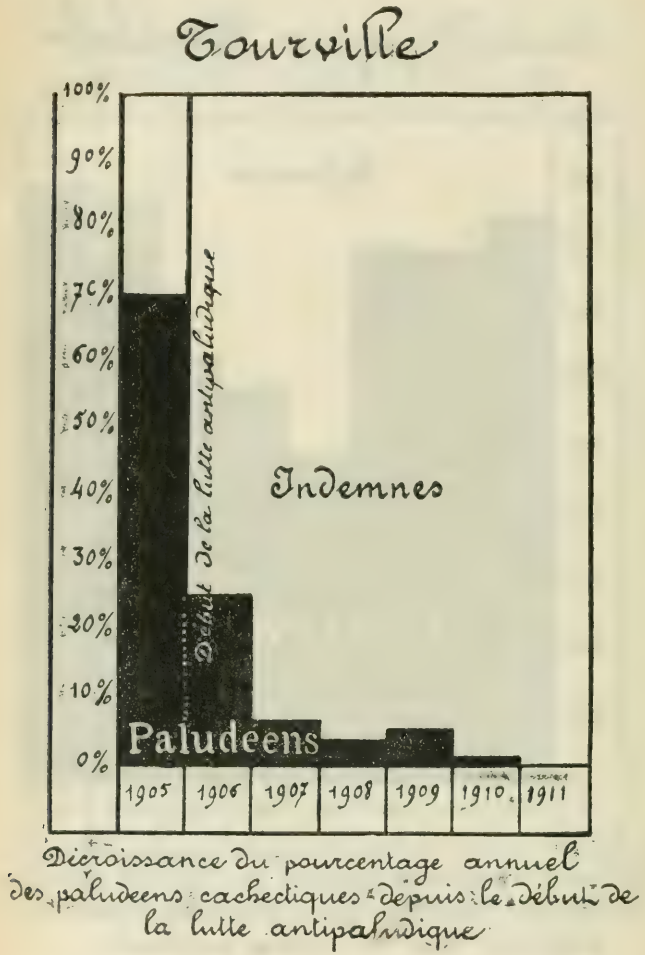


quels figure A. Celli, préfèrent la quininisation préventive (F). Nous sera-t-il permis de rappeler à ce sujet le rôle de Maillot, qui, par ses recherches en Algérie, apprit dès 1836 aux médecins à se servir de la quinine?

Depuis 10 ans, nous avons expérimenté les différents procédés de la lutte antipaludique dans toutes les régions algériennes et dans tous les milieux. En particulier nous avons organisé et surveillé de près

dans chaque département algérien un "champ de démonstration" où nous éprouvons la valeur des méthodes et en précisons les modes d'application, pour l'enseignement des colons.

Dans les champs de démonstration (village de Montebello pour le Département d'Alger, village de Tourville pour le Département d'Oran, village de Mondovi pour le Département de Constantine)

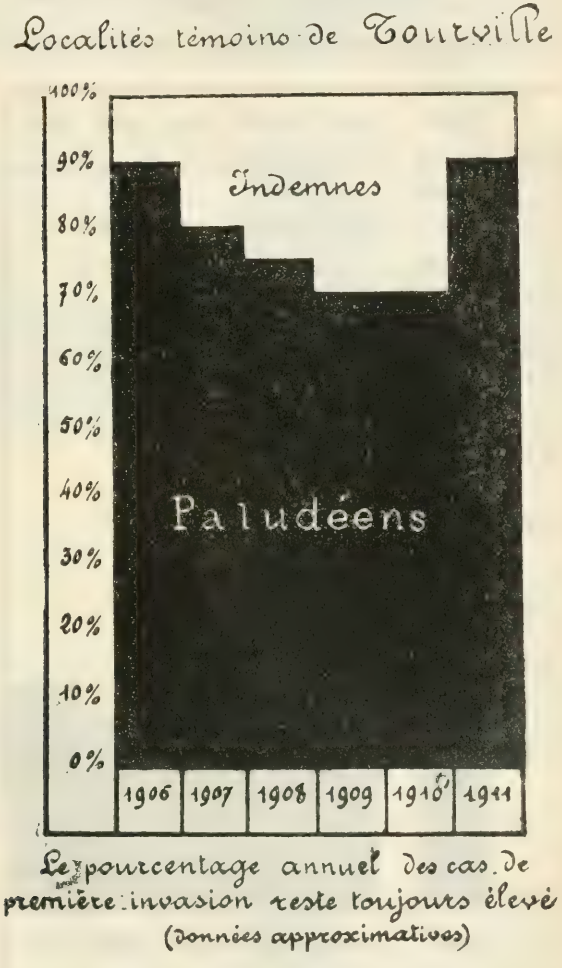


sont appliquées les petites mesures antilarvaires (D) et la quininisation (F, G). De plus, un certain nombre de fonctionnaires profitent de la protection mécanique des ouvertures de leurs logements (I).

Les tableaux ci-joints montrent l'effet de ces mesures, soit sur la morbidité des sujets exposés (pour Montebello et Tourville), soit sur l'index endémique (pour Mondovi).

Nous aboutissons aux conclusions suivantes:

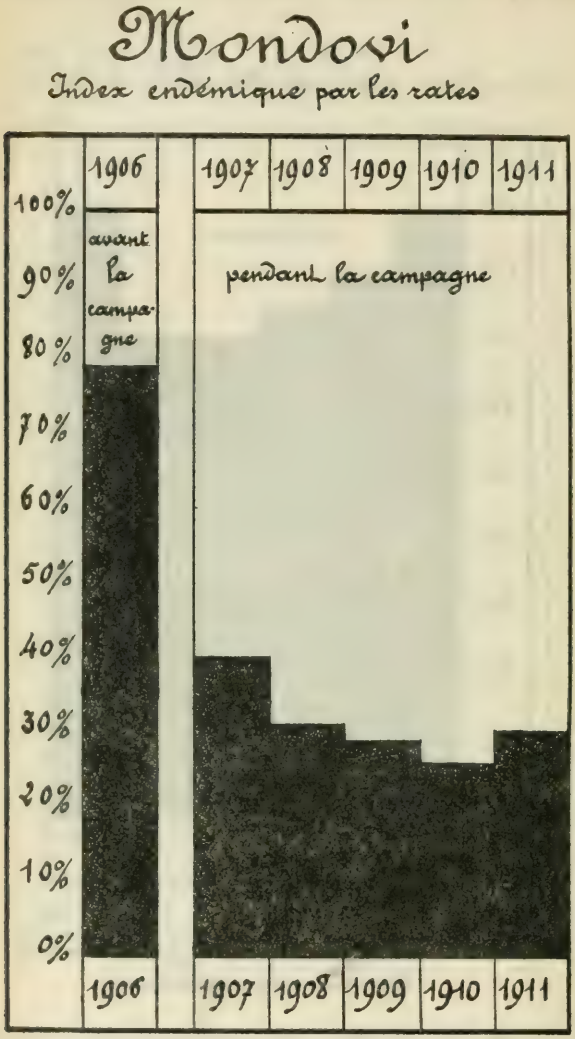
I. *Un particulier isolé* se protège par la quininisation journalière préventive (F) (20 ou 40 centigrammes de quinine), par la moustiquaire de lit (H), et en évitant le voisinage du réservoir de virus (anciens infectés-indigènes principalement) (B) et des gîtes à Anophélines (A).



II. *Une collectivité* (famille, administration, etc.) se protège par la quininisation journalière préventive (F); par la défense mécanique collective (I); (grillages aux portes, fenêtres et cheminées); par le choix de l'habitation loin du réservoir de virus (B) et des gîtes (A); par les petites mesures antilarvaires (D).

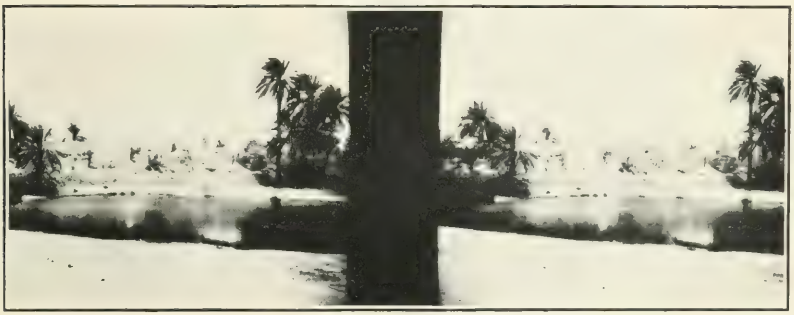
III. *L'action de l'État* doit avoir pour but l'amendement du réservoir de virus, constitué surtout par les indigènes.

Leur quininisation journalière à petites doses agit curativement (G) et préventivement (F). Pour être efficace cette quininisation doit être confiée à des agents sûrs, placés sous le contrôle du médecin, et qui font absorber la quinine devant eux. En Algérie, le Gouvernement, par une entente avec les pharmaciens, a pu assurer la diffusion,



a bas prix, du bichlorhydrate de quinine en dragées (20 centigrammes de bichlorhydrate dans 30 centigrammes de sucre). Ces dragées sont distribuées gratuitement aux personnes participant aux campagnes antipaludiques.

Il est bon de joindre à la quininisation curative et préventive les petites mesures antilarvaires (D). De cette façon, en même temps



que l'on diminue le nombre des germes sexués du sang périphérique, " source de la contamination," on diminue le nombre des moustiques, " vecteurs de la contamination."

Les petites mesures antilarvaires ont pour effet de désinfester provisoirement une région très localisée où se trouvent anciens infectés et sujets indemnes, pour que le voisinage des premiers ne soit pas nuisible aux seconds et que ces anciens infectés aient le temps de guérir par l'amélioration du bien-être général et la cure quinique.

L'éloignement des gîtes (A) peut être la méthode de choix dans certains cas: au Sahara constantinois plusieurs bourgs de quelques milliers d'habitants chacun sont infectés par le voisinage de ma-

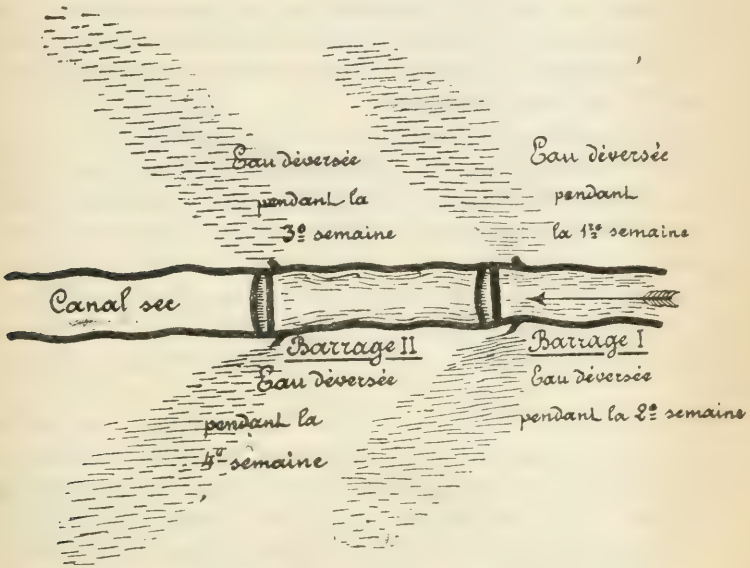


Schéma d'une dérivation alternante et périodique de l'eau d'un canal, pour maintenir celui-ci à sec

récages formés par des puits artésiens; les autorités font évacuer ces bourgs et les rebâtissent à bonne distance des palmeraies. (Voir les photographies ci-jointes.)

Les grands travaux de desséchement (C) qui sont une nécessité pour l'agriculture, ne sont utiles à l'antipaludisme qu'indirectement, et quand ils sont complétés par les autres mesures.

L'Etat doit non seulement réduire progressivement le réservoir de virus par la quininisation et les mesures antilarvaires, et choisir judicieusement l'emplacement des centres de peuplement, il doit aussi faire l'éducation du public, et enseigner l'hygiène antipaludique, surtout à l'Ecole.

RECENT PROGRESS IN ANTIMALARIA WORK, WITH SPECIAL REFERENCE TO ANOPHELES FLIGHT AS STUDIED ON THE ISTHMUS OF PANAMA.

J. A. Le Prince. C. E., A. M., Chief Sanitary Inspector, Isthmian Canal Commission.

It is generally believed that certain species of Culicidæ travel with a light breeze for long distances. Probably it is this fact that has given the impression that all mosquitoes, including anophelines, are blown by or travel with the wind.

In antimalaria work it is essential to find out, as far as possible, what local species of anophelines transmit malaria and then eradicate or control the propagation areas of those species that are within flight range of the area to be protected.

If anophelines are blown by or travel with light winds, it would evidently be necessary to do more control work on the windward side of a settlement than on the leeward side. Comparatively little work would be necessary on the leeward side if the prevailing wind were more or less continuous. This matter is very important, and the time has now arrived when antimalaria work should not be carried on without careful study of the species that convey malaria; especially with regard to the distances and direction in which they travel.

On the Isthmus of Panama most of our malaria is transmitted by *Anopheles albimanus*, and it is concerning the flight of this species that we have been most interested. The subject has been studied for a long time at the settlements of Ancon, Corozal, and Miraflores. Ancon is adjacent to the city of Panama, while Corozal and Miraflores are about three and six miles, respectively, to the northward. The laborers' camps at the three localities are less than fifty feet above tide level.

Several years ago when the mosquito-control work was already well advanced, it was noted that anophelines were not as numerous at the laborers' camp at Ancon as at other stations, although there was a large swampy area to the north of it that contained anopheline larvæ. The prevailing winds on the Isthmus are fairly continuous and blow from north to south. It was not understood why anophelines did not come with light breezes from the swamp referred to. This condition of affairs continued, and was an incentive to further observation and investigation.

Corozal camp is located about midway between Ancon and Miraflores. To the north of the camp is a nearby swampy area of large extent, while to the south and a little over a mile distant is another

extensive anopheline-producing swampy area. During the dry season of 1911 there were no anopheles production areas within one mile to the south of Corozal, and antimalarial operations were concentrated at the swamp to the north. In spite of the work done, many thousand anophelines appeared each week at Corozal, and from one to two thousand were caught in one building. As the result of the work on the windward side was a failure, an extra brigade of laborers and oilers was put to work in the swamp more than a mile to the south of Corozal (to the leeward). As soon as that area was under control the anophelines at Corozal practically disappeared.

This area has since been kept under control and no large influx of anopheles has reoccurred at Corozal, except with a change of wind. It was thought advisable to determine what effect the swampy area to the north (windward) of Corozal had on the number of anophelines at Corozal. We therefore stopped all oiling and other control measures beyond a distance 2,500 feet north of Corozal camp. Although millions of anophelines larvæ and pupæ soon appeared in the swamp to the north, the number of adult anophelines that reached the camp at Corozal decreased. It seemed quite evident that there was very little flight in the direction of the wind toward Corozal. During November, 1911, when the wind blew from south to north, the anopheline catch at Corozal at once increased. At that time there was no important production area to the south of Corozal. It would appear therefore that here are two cases in which anophelines do not fly with the wind and two cases in which they fly against the wind.

To attain more accurate data, other matters were considered. The number of electric lights at Corozal was increased and then decreased, but this had no apparent effect on the number of adult anophelines reaching the buildings. No anophelines occur in empty houses. It would therefore seem possible that some species of anophelines are attracted by scent; and this may be one of the reasons for the flight of some anophelines against the prevailing wind direction. An anemometer was installed near the camp, and observations indicated that when the wind velocity was less than four miles a considerable influx of *Anopheles albimanus* occurred, and that the numbers diminished rapidly as the wind velocity increased above that rate.

From Corozal to Miraflores there is a large flat area which has been flooded during the past few years, and the number of anophelines caught at Miraflores has increased since this topographical change occurred. This new propagation area affects Miraflores, which is on the windward side, but does not apparently affect Corozal unless the wind blows south to north.

When anopheline pupæ become very numerous in this large area, the catch at Miraflores increases rapidly, while the catch at Corozal remains relatively small. There seems to be sufficient evidence that the *A. albimanus* travel against a four-mile breeze for distances of a mile. It is possible that this is not the limit of distance. Observation indicates that they do not fly so far in the direction of the wind. It is not yet known just how much flight there is at an angle to and with the prevailing wind direction.

It is thought that other species of isthmian anophelines do not travel as far as the *A. albimanus*. They do not occur at settlements located nearer to their propagation areas than to the *A. albimanus* production area. Also when anopheline larvæ of several species occur in large numbers in an area far distant and to the leeward of a settlement the adult *A. albimanus* appear in the houses in large numbers, while the adults of other species are relatively scarce.

The information above outlined has been of practical and financial value, as it is now possible to achieve more prompt and lasting results for a fixed amount of allowable expenditure, and to neglect antianopheline work in areas that seem to be a menace, but which in reality produce few or no anophelines that will affect the camp under consideration.

It will be of interest to obtain more accurate data concerning the flight habits of other malaria-conveying species of anophelines, and undoubtedly the necessary investigations will be made. It now appears that nearly all of the malaria in the zone is caused by the *A. albimanus*. It would be most desirable to determine how far it will travel in the direct line of wind, in a diagonal direction with the wind, and also diagonally against it, so that the approximate area where control work should be done can be more or less definitely determined in any district before an antimalaria campaign is started. It would not be satisfactory to determine the maximum length of flight and use that as a radius of a circle in which antimalaria work should be accomplished. Even if sufficient funds were available to obtain desired results in such an area, they would be improperly used, for a great part of the work would be of little value.

More extensive study of habits of anophelines is essential to ascertain the area in which they operate. Such experimental work is now being accomplished in the Canal Zone by means of anopheline traps, tents, etc., and data that will be of practical value in antimalaria campaigns in the tropics is now being obtained.

A NATIONAL COMMISSION FOR THE STUDY AND PREVENTION OF MALARIA.

CHARLES F. CRAIG, M. D., Captain, Medical Corps, United States Army.

It is my purpose in this short paper to bring to the attention of the section the value of a national commission for the study and prevention of malaria in the restriction of the disease. It is a well-known fact that no matter how great our knowledge is regarding the etiology of disease and how earnest we may be in our efforts to restrict the same, we are often rendered helpless because of the ignorance of the public and of lack of organization among ourselves. But little can be accomplished by any one individual, but if a number of enthusiastic and properly trained individuals be associated in the study and prevention of a disease, and if, moreover, they be supported by the National Government, a great deal may be accomplished, and in the case of infections like malaria a nation may be practically freed from the disease with comparative ease.

The most striking example of the great value of a national commission for the study of malaria is that furnished by the Italian Society for the Study of Malaria and what it has accomplished in the restriction of the disease in Italy. This society has conducted a campaign against these infections so successfully that immense areas have been rendered habitable that were formerly so dangerous that no one could live in them, and has reduced the number of deaths from malaria in Italy from 16,000 annually to less than 4,000. The society has kept a large force in the field studying the endemic centers of the disease, devising the best methods of prophylaxis for each locality, discovering and properly treating the latent infections, and instructing the people regarding the treatment and prophylaxis of malarial infection. In fact, it may probably be truthfully stated that in all Italy there is no one so ignorant as to doubt the efficiency of the methods instituted by the society for the suppression of the disease or who does not know why they were instituted and how they are proving successful.

Wherever organized effort has been made to prevent malarial disease it has met with a greater or lesser measure of success, the success generally being proportionate to the efficiency of the organization. Such instances as the success attending malarial restriction upon the Isthmus of Panama, in our Army posts in the Philippines, in the British cantonments in India, and elsewhere are familiar to all of us, but the significant fact has sometimes been overlooked that the greatest measure of success has always followed operations

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supported by the Government concerned, and that where the measures have depended upon local interests, though successful for a while, almost invariably the expense has proven too great or interest has gradually declined and eventually the malarial infections have conquered.

It is for this reason that I believe that it is only when our prophylactic measures are instituted and supported by the National Government that they will meet with the fullest measure of success. In our own country it is well known that malarial disease constitutes one of the greatest barriers to the prosperity of the Southern States, especially those bordering upon the Gulf of Mexico and in the Mississippi Valley. In these regions there occur annually thousands of cases of malaria, a very considerable proportion of which are of pernicious type. Many localities are practically uninhabitable because of these infections, while in others the inhabitants lead a miserable existence, continually hampered in their work by recurring attacks of fever, and rendered weak and inefficient by the constant presence in their blood of the malarial plasmodia. Despite the known prevalence of malarial infections and their effect upon the population, but little has been done in the South in the way of an organized attack upon the disease. Prophylactic measures have been largely of local character and sporadic in nature, and it may be said with truth that, until very recently, the South had accomplished practically nothing in the prophylaxis of a disease of far greater importance than hookworm disease, about which so much has been written and against which so successful a campaign has been waged by the Rockefeller Commission.

The great economic importance of malaria can not be overestimated. A people suffering from earliest infancy from malarial disease can never be as productive, either mentally or physically, as a people free from such infections, other things being equal. A survey of the most malarial regions of the world amply demonstrates this fact. Occupations requiring strength and endurance, such as agriculture and mining, can not be efficiently prosecuted by a people whose physical vigor is sapped by frequent attacks of malarial fever, while the peculiar localization of the malarial plasmodia in the capillaries of the brain, so frequently observed, furnishes an anatomical reason for the lack of initiative and ambition in the victims of this insidious disease. For these reasons the prophylaxis of the malarial fevers becomes an economic duty, and no State or municipality can lose financially by adopting the proper methods for the eradication of the disease.

Realizing this fact, the Southern Medical Association, at its last annual meeting, appointed a commission for the study and prevention

of malaria in the South, and it is hoped that much may be accomplished by this commission in the prevention of the disease. However, the South is not the only portion of the United States that suffers severely from malaria, for many States of the West and Middle West contain endemic centers, so that the prophylaxis of malaria is really a national question and should receive national support.

The functions of a national commission for the study and prevention of malaria should consist in the education of the public concerning the disease; the discovery and treatment of latent infections in the endemic centers of the disease; the investigation of the fevers in malarial localities with a view to determining the proportion actually due to malaria; and the careful study of each endemic center in order to determine what method or methods of prophylaxis could be most economically and successfully employed. In this way a malarial survey of the infected areas could be secured and an intelligent effort could then be made to eradicate the disease. At the present time the greatest confusion exists regarding the exact nature of the prevalent fevers of many localities in the United States, and if nothing more were accomplished by a malarial commission than the scientific classification of these fevers a great good would have been accomplished and the existence of the commission amply justified.

What I have just said regarding the value of a national commission for the study and prevention of malaria in the United States is applicable to every nation in which the malarial infections are so prevalent as to constitute a serious obstacle to its progress, and I can not but believe that in such a commission we have one of the most valuable aids in the restriction of these infections. Especially do I hope that before long the excellent example of the Southern Medical Association in appointing a commission for the study and prevention of malaria in the South will be followed by the National Government, and that we will eventually have a national commission for the study of the disease in the United States. Italy has pointed out to the world the proper legislative control of this disease, which for centuries had rendered her lands barren and destroyed hundreds of thousands of her inhabitants, and the enforcement of similar prophylactic measures in this country will be followed by equally successful results.

DISCUSSION.

Dr. A. J. Orenstein, Canal Zone: Quinine prophylaxis is not considered of great importance in the antimalaria campaign in the Canal Zone. Most of our dependence is placed on drainage. Drainage to be effective must be carefully planned—it must drain.

The anophelinæ on the Isthmus of Panama breed especially in stagnant water. The breeding in running water is inversely proportional to the velocity of the streams. Pockets in streams are frequently breeding places of anophelinæ.

Considerable has been said by observers who have not been connected with the work in Panama, about the importance placed on clearing and grass cutting in Panama. Clearing is considered of secondary importance to drainage. We clear in Panama (1) to remove shelter for the larvæ and pupæ of mosquitoes; (2) to hasten evaporation; (3) to expose breeding places to view; (4) to remove shelter for imagos; (5) to discourage the throwing of tin cans, etc., into the vegetation near dwellings, in which mosquitoes will breed; and (6) to prevent the breaking up of oil films by the vegetation projecting through the film.

In Panama dependence in the antimalaria campaign is placed primarily on properly installed drainage.

Col. L. M. Maus stated that in warm and tropical climates the chill was rarely associated with malarial fever. Thousands of people in such climates suffer for years with chronic malaria and when transported to cold climates have chills at once. Col. Maus states that barrack screening and bed nets are essential in military life—nets should form a part of every soldier's kit. Col. Maus experimented on different sizes of mesh, and found out by a series of traps baited with raw bananas that the anopheles and stegomyia could pass through the 16 mesh to the inch, but could not pass through 18 mesh to the inch.

Dr. Olpp, Tübingen: It has been stated by the first speaker, if I am right, that the question has never been studied, how quinine is digested. Now, just allow me to tell you that this question has been thoroughly treated since 1908 by Giemsa, von Prowazek, and Werner, of the Hamburg School, and by Plehn at Berlin. Nearly at every meeting of the German Society of Tropical Medicine something has been published about this question.

Col. V. Havard, United States Army: Prof. Celli's paper, as would be expected, presents many points of great interest. I am especially struck by the large amount of quinine used in Italy year after year, distributed gratuitously by the Government. Of the efficacy of quinine as a prophylactic there is no question, but after all, it does not

strike at the root of the problem. Quinine is only a temporary measure, a makeshift as it were. The cause of the evil is the anopheles mosquito, and its extermination should be the chief aim of our efforts against malaria. I speak with some personal knowledge of the subject. I came from a town on the Connecticut shore which until this year had always been plagued with the mosquito nuisance. This season over 1,000 acres of swamps were drained and all breeding places abolished, with the startling result that for the first time in the memory of the oldest inhabitant the people of the town are now able to enjoy their porches in perfect comfort at any time of the day and night. If drainage is so efficacious with the salt-water mosquito (*Culex solicitans*) why should it not be equally so with the anopheles? We know that the Italian Government has done extensive drainage work; it would be interesting to know the nature of it and to what extent it has been successful in eliminating the anopheles.

Mr. Frederick Knab: We can not question the splendid results obtained by Prof. Celli in Italy. But what is true of one locality is not necessarily true of another. In Brazil it has been found impossible to control malaria through quinine. This was true on the River Xerem, in southern Brazil, when the administration of quinine was carried through in the most energetic manner with the largest possible doses. Even now striking results were obtained recently on the upper Madeira and the results of the Brazilians there has been confirmed by German investigators.

Prof. Creighton Wellman, New Orleans: I wish to deprecate the idea, which seems to obtain in the minds of some members of this section, that quinine prophylaxis is of little or no value. While it is true destruction of all anopheline breeding places would be the ideal, yet all who have studied malaria in the Tropics know that this is too often impossible or of prohibitive cost. My own experience in the Tropics, extending over a number of years, coincides with those observers who consider quinine prophylaxis to be a most valuable and vital asset in the control of malaria. In my opinion, the summing up of the relative value of quinine prophylaxis is most fairly and forcibly summed up in the published writings of Craig, who considers that when anopheles breeding places can not be destroyed the systematic administration of quinine, with screening of houses and the proper use of mosquito nets, is and must long remain of the greatest value as an antimalarial measure.

Regarding the suggestion in Capt. Craig's paper, I consider that the action of the Southern Medical Association in establishing a commission for the study and prevention of malaria should pave the way for a national commission for the same purpose. The action of Italy in this regard is a matter for congratulation and emulation.

Dr. THAYER, Baltimore: The conditions existing in America are discreditable to this country. In the important studies which have been made in late years of hookworm disease we have forgotten that, though these cases represent a certain proportion of what we roughly regarded as malaria, there remains yet in many parts of our country a mass of malaria which is far more deadly and which is, as yet, practically unattacked.

If anything has come out of this discussion it is that there is no one sovereign method of prophylaxis equally applicable to all localities, in all climates, and under all Governments.

The first step in any properly conducted antimalarial campaign must be a careful determination of the prevalence of the disease and a study of the general and local conditions—geographical, climatic, political.

While there can be no doubt that the complete eradication of the breeding places of anophelines is the ideal prophylactic method, yet there are many regions in which such methods are, to say the least, temporarily impracticable. And it would be folly to deny the great efficacy, under such circumstances, of personal protection and of quinine prophylaxis as carried out so brilliantly by the Italian society under the lead of Prof. Celli.

It is important that the question of malarial prophylaxis should be taken up in America by a central commission supported by the Government or endowed.

The examples offered by the antimalaria campaigns in other countries, notably in Italy, in Greece, and in India may be of material help.

It would seem to the speaker that a central commission, cooperating with local health authorities, might gain material assistance through the organization of a subsidiary popular society for the study and prevention of malaria, with branches in the various States.

The steps which have already been taken by the Southern Medical Society in appointing a commission to investigate the general subject of malaria in the Southern States is a step in the right direction.

Capt. CHAS. F. CRAIG, Medical Corps, United States Army: Regarding quinine prophylaxis my views have been well expressed by Dr. Wellman. The ideal method of preventing malaria is by mosquito destruction, but in many localities it is impossible to destroy the breeding places of mosquitoes and then quinine prophylaxis must be resorted to as well as other measures. To deny that quinine is of value in prophylaxis is to also claim that it is of no value as a specific for malaria. If the drug is capable of destroying the

plasmodia during an attack of the disease it will surely be capable of destroying them when introduced by the mosquito. Quinine is just as much of a specific when used as a prophylactic as when used as a remedial agent. The results achieved in Italy furnish an incontrovertible argument in favor of quinine prophylaxis.

I was greatly interested in the facts regarding the length of flight of anopheles mosquitoes brought out in Dr. Le Prince's paper. If I remember correctly some one published a paper from the Canal Zone about two years ago in which it was claimed that these mosquitoes could not fly over half a mile. I am glad to learn that further observations have proved that anopheles can fly for a mile against the wind and probably farther, for it confirms my own observations, previously published, and which have been contradicted by some writers. These observations undoubtedly show that the anopheles possess a very strong sense of smell and it is probable that, if the wind be favorable, they may detect the presence of man for great distances, and by either interrupted or continuous flight finally reach their victim.

THE DISSEMINATION AND PREVENTION OF YELLOW FEVER.

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In order to avoid possible misunderstandings, I shall not enter into any argument regarding the relative merits of the observations of Beauperthuy and Knott and others, but no discussion of this subject would be fair unless it embodied the credit which is due to Carlos Finley for arraigning the stegomyia as the guilty party in the dissemination of yellow fever, and which did not recall the wonderful clinical observations of Carter in the Mississippi outbreak of 1898, in which he noted the remarkable apparent discrepancy between the incubative periods of the first secondary case in a house and those following it. This is true, because the notes of these two men were the most important factors in leading the United States commission, under Reed, to pursue the proper line of research from the start.

To that commission—Reed, Carroll, Lazear, Agramonte—we owe the definite, conclusive, irrefrangible proof that the female *Stegomyia calopus* is the transmitter of yellow fever from man to man; that she receives her infection during the first three days of the man's illness and does not herself become dynamic for evil short of 10 or 12 days, and the further proof that the mosquito is the sole means for such transmission, though naturally we can not positively say that some

other of this genus may not also transmit the disease until all have been tried. It is superfluous to recite the findings of this commission, as they are known to the whole world, but because there has been some little inclination shown to still believe in the transmission of the disease by fomites, I think it not amiss to report a few additional facts coming under my own observation and bearing on this phase of the matter.

During the 1905 epidemic in New Orleans, I arranged that all of our prophylaxis, without exception, should be based upon the findings of the Reed commission, and, pursuant to this policy, our yellow fever hospital was screened at every opening so effectively that no mosquito could ever effect an entrance. Only one portal was provided for entrance and exit, this being fitted with triple doors, two strong electric fans blowing outward day and night, and a boy standing in the vestibule to locate and destroy any chance entrant.

All fomites—soiled bed linen and clothing stained with vomitus, fecal matter, and blood from over 200 patients suffering from yellow fever—were carried without any disinfection whatsoever to one of the benevolent institutions of the city where they were laundered, and it is a notable fact that this was the only institution in the city which went scot free from yellow fever during the entire epidemic of 1905.

Our hospital was manned as to medical staff, nurses, cooks, waiters, scullions, etc., with absolute disregard for the question of immunity, and no member of the personnel became infected, save one young woman, who subsequently confessed that she had violated her obligations and had slept one night outside in what was afterwards proven beyond a doubt to be an infected house.

Patients were freely permitted to be seen by friends and relatives, and more than once whole families were taken into the hospital and held under observation while one of their number was sick with yellow fever and their house was being fumigated, nor was there the slightest reason to suspect that any infection was ever transmitted in this wise.

From the evidence of the commission, and from my own observation in connection with this hospital and with three or four epidemics, it appears to me that there is no logical reason to believe that there is any other means of transmission save through the female stegomyia which has bitten an infected person during the first 72 hours of his fever.

The disease presents itself in what has been arbitrarily classified as endemic and epidemic form.

The endemic existence of yellow fever depends upon two factors—first, the constant presence of mosquitoes of the genus stegomyia, and,

second, the presence of a constant supply of nonimmune material (people), this latter factor being supplied in two ways: One by population large enough that its birth rate will supply the nonimmune material, as is the case in such cities as Habana or Rio Janeiro; the other by the steady incoming to a smaller town of people from clean back country, such as is notably the case in places like Cartagena, where the Paesanos bringing togua nuts, are constantly arriving, resting a few days, and going home.

Such cities as Guayaquil and Vera Cruz may supply both conditions.

The *Stegomyia calopus* is, according to my observation, entirely a domestic mosquito, and while I would not for a moment assert that under such conditions as might absolutely annihilate all human habitation near by, it might not breed in natural pools, it is nevertheless true that, as matters ordinarily stand, it breeds always in artificial water containers, such as cisterns, barrels, tubs, buckets, broken bottles, cans, stagnant drains with brick, stone, or cement sides, etc. It seems to instinctively avoid water vehicles having weeds and grass around their margin, and I remember a conversation on this subject with H. W. Thomas, of Manaos, in which I developed the fact that the one breeding place known to him which was not deemed artificial really fulfilled artificial conditions in that it was a cleft in rock and entirely free from vegetation.

No less authority than Howard states that the stegomyia gives evidence in its method of attack of long acquaintance with man, since it always attacks from the rear or under the lower edge of a garment and never where it can be easily slapped. He considers it almost as much domesticated as the barnyard fowl. Everyone has probably confirmed Dr. Howard's findings in that respect, and also with regard to its habit of biting at twilight after it has once become accustomed to blood feeding, though prior to that time it is not so discriminating.

In 1905 I called the attention of Sir Rupert Boyce to the domestic character of this mosquito and found him distinctly incredulous regarding my statement that I had never found a mosquito in any save artificial water containers, but I had the pleasure some months later of meeting Dr. Boyce on his return from Central America and the West Indies, where he had verified my observations to the fullest possible extent, failing utterly to find the stegomyia in crab holes and other likely natural pools.

This is apropos, in connection with the statement of J. De Goyon, in Revue Scientifique, September 23, 1911, where he says, regarding French West African work, in which much attention was paid to

crab holes, that "vast numbers of crab holes all along the coast offer protection to the mosquito," and without noticing the apparent discrepancy and almost in immediate connection says, "Le Moal having shown that the mosquitoes which inhabit crab holes were principally *Catageiomyia senegalensis* and *Uranotaenia annulate*." He then makes this significant statement: "The larvæ found in odd water receptacles nearly exclusively belonged to the genus stegomyia." He calls attention to the danger from nonreported cases and advises a change in the manner of house construction, gutters, etc. All of his observations are excellent, but it is strange that he fails to note that slipshod wooden gutters furnish excellent breeding places.

K. S. Wise, in the Annals of Tropical Medicine and Hygiene for December 30, 1911, also notes that "*Stegomyia fasciata* and *Culex fatigans* were found only in close proximity to human habitations. * * * The larvæ of stegomyia were never present in trenches nor unoccupied lands." This corresponds precisely with my own observations stated at the 1905 meeting of the American Society for the Advancement of Science.

Wise also states that the anophelines do breed in trenches overgrown with vegetation and in hollow stumps, etc., and that clearing arrests such breeding, and these facts are pertinent in a way to this discussion because malaria always tends to confuse diagnosis, and no effort should be spared to eradicate malaria coincidentally with yellow fever.

The question of the flying radius of the stegomyia has given rise to much discussion, and for that reason I would submit some further observations of my own having bearing thereon.

During July, August, and September, 1905, the old French quarters of New Orleans, known as the Vieux-Carre, was the most pronouncedly infected section of the city.

The Louisville & Nashville Railroad runs through the river side of this section to its passenger station at the head of Canal Street. I purposely permitted unscreened passenger trains of this line to go out every day with every seat full of passengers bound through to the North, and these trains were boarded at the Mississippi-Louisiana State line by young guardsmen of the Mississippi State Guard, all of whom were nonimmune, who rode in the coaches across the whole State of Mississippi with passengers to the Alabama State line, where Alabama men took up the task of seeing that these passengers did not debark in infected territories. I did this on the basis that there was no place where these cars would come within less than 50 yards of a dwelling and with a well-grounded faith that no stegomyia from an infected room would ever fly 50 yards in the open

sunshine. The result showed that my faith was well founded, inasmuch as there was not a single case of any kind of fever among any of these young guardsmen, which there certainly would have been had there been any infected mosquitoes in the coaches.

Naturally the coaches would have been fumigated had any illness occurred at all.

Again, on Burgundy Street a long, low house, the middle one of three just alike, with coincident windows, mostly open, with not more than 15 or 20 feet between houses, became infected and remained infected for about 35 days before it was discovered, and every member of the family had the disease. Neither the neighbors to the right nor to the left visited this house and neither did any of them get fever, though other people at some distance who did visit the house became ill of yellow fever.

I am quoted by Rosenau as saying, in 1908, that yellow fever never crossed the street save on a pair of shoes, and I am now even more strongly convinced of the almost unfailing rule that to become infected with yellow fever one must enter a room with rather dim light where yellow fever has been at least 15 days before.

It is not to be denied that under conceivable conditions an infected mosquito might be imprisoned in a bag or piece of furniture and carried to some distant point nolens volens, but the contingency is so remote as to be hardly worthy of consideration or discussion.

It is most unfortunate that so much of our work must of necessity be based on deductive reasoning rather than cold facts, but it is nevertheless so, and for this reason I have submitted so much data of this character.

In the sick room the infected blood-feeding stegomyia finds all the congenial conditions of shade, blood, and moisture, and, abominating sunshine, she remains there, having practically changed all of her living habits since she tasted human blood, and, so far as my knowledge goes, she will never leave there, unless the sick are removed, the room abandoned and left without even water, as happened in one instance in Baton Rouge, when an obscure case was finally traced to the proven fact that the victim slept in an open bay window within 10 feet of an old abandoned shack, where an Italian couple, who had fled from the New Orleans epidemic, camped for a week, during which time the man had a mild attack of yellow fever, and they then fled again, leaving their infected stegomyia behind them to infect. 18 days later, the woman sleeping in the open bay window. This is the only case known to me where conditions would force the migration of the insect.

The prevention of yellow fever resolves itself naturally into—

First. The prevention of mosquitoes breeding, with the destruction, where practical, of existing mosquitoes as a secondary phase.

Second. The isolation of the sick man, together with his infected mosquitoes, and the final destruction of these infected mosquitoes.

The former proposition is naturally one of vital interest in dealing with an endemic center, and in the latter is the one which comes insistently to the fore in dealing with an acute outbreak demanding rapid and immediately effective work.

In attempting to prevent breeding, it is by all means the wisest plan to attack all mosquitoes and their breeding grounds without regard for genus or species, because in so doing we shall meet before it arises the ever-possible question, May we not force the stegomyia into new breeding grounds such as puddles, swamps, etc.? And, again, because by attacking all mosquitoes we eliminate complications in the way of diagnosis.

All ground within a quarter of a mile or more of the area to be treated should be reduced to ordinary dryness by drainage ditches, and, in the end, by a full system of subsoil drains, so that there will be no surface water to contend with anywhere, bearing in mind that even ditches may pocket in places here and there and breed mosquitoes.

Thorough policing of the whole area not less frequently than once each week, and preferably once every five days, is essential, and is to be coupled with a total clean-up of each and every chance water container, such as tin cans, broken bottles, etc., as well as grass and weeds in damp corners of the yard. All regular water containers, such as cisterns, barrels, buckets, tubs, and things not often remembered, such as church fonts and cemetery urns, must be inspected at similar short intervals to see that they are not breeding mosquitoes, and to this end screens of 18 meshes to the inch should be used on all containers, or a constantly renewed covering of refined petroleum to their surface. For the fountain a good head of water and a number of small fish will suffice. The little minnows, known by the Jamaica negroes as "millions," serve this purpose very nicely. For the font, either a tablet of bichloride or a small crystal of cupric sulphate or frequent renewal is suggested, and the same rule will apply to the funereal urn, which I have seen swarming with stegomyia.

Present experience has shown me that the people will promise all of these things and not do one of them, despite good intentions, and that the paid lay inspector will do all or some of them as long as he is under the eye of the sanitarian, or feels that he is, and no longer.

Among the many places to be watched as possible breeding grounds, the manhole of the city drainage and sewerage system is not to be forgotten, nor is the sagging roof gutter, which is a prolific source of danger, especially where shaded for most of the day, and the remedy for the latter is simple—punch a hole in the dependent part with a ten-penny nail, unless it can be torn down entirely. The total removal of all roof gutters, allowing the water to fall into paved ground drains and run freely off, is the ideal way to meet this question, and is the method adopted on the Canal Zone.

As to the destruction of mosquitoes of the genus Stegomyia, it is not impossible, as was proven in New Orleans, but is feasible only because of the habit of the stegomyia to seek dwelling with man, making it possible to destroy them by house fumigation; but it must not be forgotten that such measures meet with strenuous objection in houses where there has been no fever, and it is possible that such work is better dispensed with, in the interest of popular cooperation, where an endemic focus is being attacked and the work, of necessity, to be long continued.

In the handling of an epidemic prompt and efficient work is demanded, and this means the immediate isolation of every sick man and his accompanying mosquitoes; nor can this be too carefully done. We are confronted in this connection with the easily overlooked, exceedingly mild case in the negro and negroid, and with the cases on which it is sometimes difficult to obtain a report which we find among the younger members of the poorer class of whites, unaccustomed to sending for a physician unless some one of the family is seriously ill. Two factors are predominant in this case: First, the perfectly honest ignorance of the class of medical men usually employed by these people, and, second, the fact that these people, more than any others, strenuously object to the attentions of the health officer. It is therefore apparent that too much attention can not be paid to the ignorant physician, to the slightly ill negro, nor the young white child in similar case.

In dealing with the houses in which cases have been found, either known to be or suspected to be yellow fever, I have been accustomed to first see whether the house has been properly screened with 18-mesh-to-the-inch wire cloth, and, if not, to have screening done as promptly as possible, using mosquito netting as a substitute for wire cloth and having the sick room itself, as a double precaution, screened off from the remainder of the house. The sick room can be easily screened by tacking two ample widths of net to the top and side of the door and having a wooden rod affixed to the bottom of each width in such fashion that the ends projecting into the door are

higher than those at the side, which will result in the rod dropping into place and pulling the folds together immediately behind anyone passing through. In thorough accord with Juan Guiteras, I attach the utmost importance not only to careful screening but also to pasting up of all cracks around the sick room, and also to the quietness with which this work is done, to prevent disturbing either patient or mosquito, and to this end I prefer that the sick-room window should be screened from a ladder on the outside of the window. In order to prevent escape or entrance through the chimney, it is advisable to place a cap on the top, or, failing in this, to burn some loose paper in the fireplace, with a little petroleum to make a rapid flame, and then cover the front of the fire place with an improvised screen of netting or paper, as the case may be.

After the patient is in condition to be removed to another room or house—three days, of course, having elapsed since he became ill—we remove him; and having pasted up every crack into which an insect may go, and opened all drawers, etc., so that the fumigant used may reach all places in the room, and taking care that we do not shut some mosquitoes between the outside screen and the window in closing it, we subject the room and its contents to either sulphur dioxide or cyanide, whichever we may elect. The whole house should be simultaneously treated in the same fashion if the patient can be removed to another house; otherwise we must treat part at a time with more than usual care.

I have never deemed it necessary to fumigate detached neighboring houses, though I am aware that some do; but in making this statement I wish it understood that I consider a contiguous and connecting house as to all intents and purposes, from a sanitary viewpoint, a part of the infected house and treat it accordingly.

On August 8, 1905, I undertook, at the request of the governor of Louisiana and the mayor of New Orleans, to eliminate an existent epidemic of yellow fever in New Orleans, which had presented to that time 600 known cases, scattered over 44 square miles of territory among a population of 335,000, and with many indeterminate foci.

I deemed it necessary, under these conditions, to make a general attack on all mosquitoes, in addition to the particular definite undertaking of killing all infected stegomyia.

The result was the total elimination of all yellow fever, nearly all stegomyia, and most of the anophelines and culicidæ by the end of October.

The work was continued for 100 days from its inception and the amount expended in round figures was from all sources $325,000, which means a fraction of 1 cent per capita per diem.

As nearly as I can arrive at the facts, we expended $50,000 for hospital equipment and maintenance and $75,000 for special treatment of suspected and specifically infected houses. This will leave $200,000 for the total cost of 100 days of general elimination work, such as would be done in an endemic center with permanent eradication in view, and includes the overhead charges for all the work, being therefore a more than ample estimate of the cost for this latter class of work. Making due allowance for slight inaccuracies unavoidable in such calculations, I would say that the cost of such work would average from 6 to 8 mills per capita per diem; less perhaps in large places and more in small towns, on account of undue weight of overhead charges in the latter.

It is certain that endemic centers have been destroyed at Habana by Gorgas, and later a reestablishment of endemicity prevented by Juan Guiteras; that the same thing has been done at Rio by Cruz, at Panama by Gorgas, and at Vera Cruz by Liceaga; and it can not be reasonably doubted that the consistent and patient application coincidentally to all endemic centers of the kind of work done as above named will destroy endemicity in the whole world; and as naturally epidemics are dependent on endemic seed beds for their existence, yellow fever will be no more, and Pasteur's postulate that it is possible to eliminate infectious diseases entirely can be demonstrated in this one.

Two years of painstaking and insistent effort should clear up any endemic forms.

CONCLUSIONS.

The mosquito is the only disseminator of yellow fever, and the female stegomyia the only genus and species proven guilty.

Yellow fever is only infective during the first three days of the attack, and the mosquito biting a patient after that time receives no infection.

The stegomyia itself can not convey the infection to man until after a lapse of at least 10 days subsequent to the ingestion of yellow fever blood.

One attack of yellow fever generally gives immunity—not always.

Feeble susceptibility in the negro is sometimes confused with immunity.

Mild cases are the rule with that race, and this causes many cases to be overlooked.

Destruction of all breeding places for all varieties of mosquitoes, and especially stegomyia, anophelenes, and culicidæ, is necessary in dealing with endemic foci.

Rapid antiepidemic work may be confined to destruction of infected stegomyiæ alone, but this is shortsighted.

THE NATURE AND CONTROL OF YELLOW FEVER.

HARALD SEIDELIN, Liverpool, England.

Yellow fever is an infectious disease produced by *Paraplasma flavigenum* and transmitted by *S. fasciata*. The latter statement has met with universal acceptance and we may at present take its correctness for granted. But it is worth while to examine the rather elaborate structure which has been erected on this foundation. The theory, as it now stands, embraces the following particulars: Yellow fever is transmitted by *S. fasciata* and by no other means, in particular by no other mosquito. The transmission can only take place after the yellow-fever parasite has undergone a development in the mosquito, the duration of which is, approximately, 12 days. Yellow-fever blood is infectious during the first part of the disease, but not after the third day. Transmission is believed to take place at night-time only. Hereditary transmission of the yellow-fever germ from mosquitoes to their offspring and infection of one mosquito from another, without the intervention of a human host, are generally considered as unproved possibilities. Each of these points must be discussed separately.

I may say at once that conclusions on these secondary points have not been drawn by the United States Army Commission. Reed and his fellow workers were very careful in their statements; but the assertions of later observers have been repeated so often that they are now almost universally believed.

The axiom that yellow fever is transmitted by no other mosquito than *S. fasciata* is an assertion entirely without proof. It is nevertheless now repeated in most textbooks and even in special literature dealing with yellow fever. In fact, no experiments have ever been made with stegomyia species other than *S. fasciata*. In trypanosome infections, in malaria, and in babesia infections, we know that insects belonging to different species, to different genera, even, may serve as transmitters. We should be careful in drawing conclusions on yellow fever with the very scarce material at hand.

That yellow fever is transmitted in nature by no other means than by mosquitoes has never been proved, but is extremely probable in view of our knowledge of protozoal diseases.

The yellow-fever germ is supposed to undergo a development in the mosquito of 12 days' duration. This is made probable by the negative results of experiments in which a period of less than 12 days had elapsed after the mosquito had sucked blood from an infected patient until it was allowed to bite a nonimmune individual. This theory corresponds well to the observations of Carter and others on the extrinsic incubation period, and is likely to be correct; but it can not be considered conclusively proved, as the negative experiments referred to were not numerous and, on the other hand, there is a comparatively large number of negative results in cases in which all conditions for obtaining positive results were fulfilled.

Yellow-fever blood is considered infectious during the first three days of the disease only, but on very scanty evidence, as I have previously pointed out. My argument has been objected to, but not shown to be erroneous, and I must again assert emphatically that we here have to do with a theory which is sorely deprived of foundation. The negative experiments of the Army commission prove nothing in this respect. In Carroll's table of 22 cases, with 32 negative inoculations, we find two inoculations only in which the patient bitten was in a later period than the third day, while the interval allowed in the mosquito was more than 12 days (13 and 14, respectively). In 10 inoculations both conditions for favorable results were fulfilled (patient bitten during first three days of disease and intervening period in mosquito 12 days or more). In the remaining 20 inoculations the interval in the mosquito was less than 12 days, which circumstance alone would explain the negative result. It really surprises me that anybody can take this table as an argument in favor of the three days' infectiousness.

The responsibility for this dogma rests with Marchoux and Simond, and theirs should be the honor for having pronounced it, should it finally prove to be correct, but proved it they have not. I have in a former paper analyzed the four experiments, which sustain their argument, and shall not go into details here. The experiments are both very few and of very relative value.

Transmission of yellow fever is said to take place only during the night. This doctrine is supported by a considerable amount of epidemiological evidence, mostly from the premosquito period. The general knowledge of *S. fasciata's* biology did not seem at first to answer the epidemiological experience, as it is almost universally recognized that *S. fasciata* bites indifferently at day and at night, or it is simply called by several authors a day mosquito, thus differentiating it from the typical night mosquito. The apparent contradiction between these experiences has, however, been explained by

Marchoux and Simond, who found that only young females, which suck blood for the first time and have consequently no chance of being previously infected, bite at daytime, while the older and possibly infected females have learned cautiousness and remain hidden during the day, to sally forth to attack in the darkness. If this holds good the old observation need not surprise us, but I do not think the question can be looked upon as finally settled. Severe mistakes might occasionally occur if nonimmunes were taught that they could during the day visit yellow-fever infected places with absolute safety. The matter is evidently of very great practical importance for foreigners, residents, and visitors in yellow-fever countries.

Hereditary transmission in mosquitoes and infection of mosquitoes by feeding on sugar water containing triturated infected mosquitoes have been observed by Marchoux and Simond in one experiment of each kind. The latter mode of transmission would probably be of quite exceptional occurrence in nature, but the former might explain some obscure epidemiological facts especially the apparently spontaneous, isolated outbreaks in sparsely populated countries.

With regard to the pathogenic organism in yellow fever I shall not discuss earlier investigations, as I have done so in another paper. I shall only refer to my own investigations, which took their beginning in 1908, and of which I published a preliminary note in 1909 and later on more detailed accounts. The limited time at my disposal does not allow me to enter into detailed descriptions, but I would briefly refer to the results obtained on the expedition to Yucatan for the Liverpool School of Tropical Medicine, from which I have just returned. The detailed report of this expedition will appear in a few weeks.

The parasite for which I have proposed the name of *Paraplasma flavigenum* has been found by me in earlier researches in over 90 cases of yellow fever out of a little more than 100 cases examined, and, in the last series, in 16 cases out of 17 cases officially diagnosed, clinically or post-mortem. Moreover, *P. flavigenum* was found in 21 cases not officially confirmed as yellow fever, but many of them clinically very much suspected of being so, and in none could this diagnosis be excluded. The diagnoses given in these cases were mostly gastric fever, bilious fever, or similar. Finally, the same intracorpuscular parasite-looking bodies were observed in two apparently healthy native children. These two cases, together with two similar ones which I have observed during my earlier investigations, may represent very mild infections, or the individuals may be chronic parasite carriers. A very large control material, consisting of over

400 cases, mostly of febrile diseases, as malaria, typhoid fever, etc., were carefully examined with negative results.

P. flavigenum has been observed from the first to the fourteenth day of the disease. There is no reason, however, to consider 14 days as a general time limit for its presence, as the corresponding case was a very prolonged one, with a pronounced recrudescence after 5 or 6 days. That the parasite has been found on the tenth day in a very mild case represents, relatively, a later stage of the disease.

The parasite is morphologically polymorph. The forms most commonly observed are small, intracorpuscular, consisting of one or two chromatin granules, and a more or less well-defined protoplasmic body. The largest intracorpuscular elements have been seen in smears from liver and spleen. Free elements have been seen, both in smears and in organs.

Many of the intracorpuscular elements are not unlike forms of babesia; others are more similar to theileria, and others to anaplasma. It has, therefore, been proposed to establish a new genus, paraplasma, in the family Babesiidæ.

The parasites stain, with some slight difficulty, with Giemsa's stain, and according to other modifications of Romanowsky's method; but in all cases staining should take place for a somewhat longer time than in the case of malarial parasites. It was an agreeable surprise that good results were obtained with Giemsa's quick method, prolonging the action of the undiluted stain to 1 minute, and of the diluted to 10 minutes, instead of half a minute and 5 minutes, respectively. Satisfactory results have also been obtained with various hematoxylin methods, especially with Delafield's solution and with Heidenhain's iron-hematoxylin, as well as with my own iron-hematein technique. The latter group of methods are particularly useful in staining sections, but are also of use in checking the results obtained with the Romanowsky method. There is at present a tendency to regard Giemsa's and other azur-eosin stains as particularly unreliable, a somewhat exaggerated tendency, I believe, but, of course, it is always a safeguard to use several methods.

Before we discuss the measures to be taken against yellow fever a few words should be said with regard to its epidemiology.

It was believed, when it was found that yellow fever is transmitted by mosquitoes, that it would only be a question of a few years to stamp it out. Now this has not been the case. It is not, however, the place here to inquire in detail why this has not been possible, but it appears that the success of the campaign in some places, and its failure in others, have supplied a remarkable proof of the correctness of the mosquito theory; mosquito extermination has been com-

paratively easy in large cities and in limited districts under the direct control of a powerful government, and it is in such places only, as Habana, New Orleans, Panama Canal Zone, Rio de Janeiro, and Vera Cruz that really demonstrative results have been obtained. Not in all of these places has the number of mosquitoes been kept continually at a very low level; in Habana I have been informed that mosquitos, including *Stegomyia fasciata*, have lately become more common than in previous years, and some authorities have told me that they were not at all uncommon in the Canal Zone. This should not be so; the careful vigilance should be kept up, as long as there is any possibility of reintroduction of infection. This possibility not only exists, but is abundantly present. We should be cautious and not feel secure too early; the history of epidemics teaches the lesson that the great infectious diseases are subject to oscillations, on which even the most radical measures have little influence.

To give an idea of the actual prevalence of yellow fever, I shall only mention that 716 deaths were officially reported in 1910 and 488 in 1911; in the first six months of 1912 there have already been about 500 deaths. There is little doubt that these figures represent a minimum. In the Yellow Fever Bureau Bulletin we completely abstain from summing up the cases reported, as it is common knowledge that the reports of cases are much more incomplete than those of deaths, and from some places the reports give only the number of deaths. If we calculate a mortality of about 20 per cent, then there would have occurred about 2,000 cases of yellow fever in the first six months of this year. This figure would include only comparatively typical cases which could be recognized clinically without much difficulty; if quite mild and atypical cases were included, the mortality would probably not attain 20 per cent.

One of the most important points in the epidemiology of yellow fever is the existence of unrecognized and unrecognizable cases. It is the experience of nearly all observers that yellow fever may present all degrees of intensity from severe, fatal cases to mild, atypical attacks of very short duration.

Cases belonging to the second group are not uncommon. Their importance for epidemiological questions is obvious. It is asserted by both ancient and modern observers that the susceptibility of an individual diminishes with the length of time during which he has resided in a yellow-fever-infected country. This phenomenon we are entirely unable to explain, if we do not admit that the (relative or absolute) immunity has developed as a consequence of acquired infection.

This matter is very clear, and will be universally agreed to, I believe, as long as we deal with foreigners. But when the same

consideration is extended to natives opposition is often met with. Nothing, however, can be more clear. If an individual is immune to yellow fever, it is reasonable to conclude that he has already gone through at least one attack of the disease.

When the immunity is considered in this way, we can form a definite idea of epidemiology. Yellow fever is endemic in certain areas, at present in several parts of Mexico, Brazil, Central America, and Ecuador, and in the Old World in West Africa. The infection is continuously maintained in a mild form in those countries, but tends to give rise to epidemic outbreaks on some occasion or other; for instance, the arrival of a considerable number of nonimmune foreigners. In the meantime, between outbreaks the infection is continued in natives who are infected in childhood, and therefore not liable to typical attacks later on. Most cases in native children are atypical and many are mild. They are consequently not recognized, but nevertheless confer a certain degree of immunity. Later in life these individuals will be exposed continually to mosquito bites and probably be bitten many times by infected *S. fasciata.* They will not, however, develop yellow fever, but either present no symptoms at all or only those of a mild febrile disorder. In the former case we would have to speak of microbe carriers; in the latter simply of mild infections. It is very likely that microbe carriers exist, but we have no idea for how long a time parasites may remain living in their blood. Minchin advocates the view that the existence of microbe carriers—i. e., symbiosis—demonstrates a higher degree of adaptation to the host than an infection which does harm to or even kills the host. In yellow fever a very well-advanced stage of adaptation seems to exist. Thus we may expect to find chronic carriers of yellow-fever microbes.

This hypothesis goes a long way to explain many epidemiological facts which remain obscure at present, especially the occurrence of repeated but separate outbreaks in sparsely populated areas (Sudan), where not even the existence of unrecognized cases with mistaken diagnosis would furnish a sufficient explanation of the persistence of the virus in the area.

Severe, even fatal, cases of yellow fever are occasionally observed in natives in endemically infected countries. The apparent contradiction between this fact and the ordinary immunity of natives may probably be explained in the following way: The large majority of natives in all places of an endemically infected country, and in populated centers practically all natives, have for centuries become infected with yellow-fever virus, each individual repeatedly, even frequently, during his lifetime. Thus a continuous supply of virus is kept up, and all individuals are continually exposed to infection. In

the case of foreigners arriving at such a place the result is that all are inoculated with the germ, and a certain percentage taken ill with typical symptoms, whilst others develop mild, unrecognized infections, and others again are quite slowly vaccinated without ever presenting pathological symptoms. Briefly we have similar differences in susceptibility as in other infectious diseases. In the natives conditions are different. They are all infected in childhood, and in this case two circumstances may concur to modify the result of an inoculation. Firstly, cases of yellow fever in childhood are often quite different from those observed in adults, a circumstance which may not influence the prognosis, but cause the disease to be called by other names. Secondly, a certain degree of immunity may have been transmitted hereditarily, antibodies having passed from mother to child; this factor would influence both prognosis and diagnosis. A few cases in native children might be both typical and fatal—that is what occurs even in large, severely infected cities—but to the rule that all children become inoculated there would be no exception. Therefore, there are no cases of severe yellow fever in adult natives in infected cities. In country districts conditions are somewhat different. Not only the number of human hosts is less, but in many cases also that of the mosquito hosts, other mosquitos taking to a certain extent the place of *S. fasciata.* Thus, it may happen in a district that the virus dies out, and, if communication is scarce, and especially if people never spend the night—the most dangerous time for infection—away from their districts, then a generation may grow up, the members of which have not acquired immunity, and have soon lost their hereditary immunity. In the case, then, that the virus is reintroduced into such a community, infection will spread and kill as it is apt to do in a country where *S. fasciata* prevails but which has hitherto been exempt from infection.

It is evident that, if so many varieties of yellow fever exist, the diagnosis must be one of extreme difficulty. And nothing can be more important for a successful campaign against yellow fever—in exposed and recently infected areas—than an early and indisputable diagnosis. A few observers (Guiteras and Lebredo) assert that an indisputable, if not early, diagnosis can be made in all cases of yellow fever, but most authors as well as most experienced practitioners whom I have met with regard this as an impossibility. Not a single symptom is constant nor pathognomonic. The relative intensity of the symptoms varies considerably. One can not lay too much stress on a careful clinical examination, but I must emphasize that I now consider an examination of the blood necessary not only to exclude a diagnosis of malaria but also to demonstrate the existence of the

yellow-fever germ. Malaria can not always be excluded because of the absence of malarial parasites, namely, if quinine has been taken, and, on the other hand, the presence of Plasmodium does not exclude the diagnosis of yellow fever, as the two diseases may well exist at the same time. The demonstration of *P. flavigenum* has in several cases enabled me to make a diagnosis of yellow fever before seeing the patient, and the diagnosis has afterwards been confirmed clinically. The demonstration of *P. flavigenum* is difficult; a very thorough examination of well-prepared and intensely stained blood smears is necessary, and the best microscopic outfit is none too good. It is almost useless to work with an ordinary twelfth-inch immersion lens. I have often seen the parasites with such a lens when I was aware of their existence and had localized them before, but for the detection of paraplasma I consider an apochromatic immersion lens in perfect shape and compensating oculars a necessity. The examination should be repeated if a negative result is obtained and the case continues suspicious. My belief is that this means of diagnosis will become as essential in yellow fever as is the bacteriological examination in plague and cholera. There may be the additional comparison with the conditions in cholera that not only persons actually suffering from yellow fever may thus be detected, but also microbe carriers. This would, of course, be a considerable advance from an epidemiological point of view.

Prophylactic measures may be divided into two groups, one dealing with the protection of mosquitoes against acquiring infection from human individuals and the other with the protection of non-immunes against the bites of infected mosquitoes. The former group includes the detection of infected individuals and their isolation, the second of segregation and mosquito protection. Mosquito-destroying measures are common to both groups and may be first considered.

We destroy mosquitoes by killing larvæ or impeding the laying of eggs and by killing adult mosquitoes. For the former purpose we have to abolish unnecessary water containers and to screen or oil such containers which can not be dispensed with, or, in some cases, to stock them with larva-eating fish. I have failed to see the advantage of substituting the use of chemical poisons dissolving in water for the generally accepted method of spreading petroleum on the surface of the water; the latter method seems to me the least objectionable. It is unnecessary to enter into a detailed discussion of larva-destroying measures; those in general use are efficient if carried out thoroughly. Unfortunately the position regarding the destruction of adult mosquitoes is not so well defined. So far

fumigation with sulphur is the method in general use; it is an efficient and comparatively cheap method, but the disagreeable smell and the damage done to metals, fruit, and vegetables is a serious drawback.

The Nocht-Giemsa method, disinfection with CO, which is recommended for the destruction of rats, is said to be inefficient against mosquitoes. I have, however, found coal gas to be a powerful culicide in laboratory experiments, but have so far made only a few experiments on a larger scale, of which the result seems to be that it is quite feasible to obtain good results in this way. The action of the gas must be somewhat more prolonged than that of the sulphur dioxide, but the cost was not considerably higher, not even in Yucatan, where gas is very expensive. As far as I can judge, the recently published fumigation with cresyl (Bouet and Roubaud) would seem even more efficient and cheaper than both the sulphur and the gas methods, without possessing serious inconveniences, and I am therefore at present engaged in a study of its practical application. The pyrethrum method is not quite reliable, as the mosquitoes become stupified only but are not killed, and cyanide and phenol camphor are somewhat expensive.

The measures which have for their object to impede mosquitoes of gaining access to infected individuals, namely, early detection of cases and their isolation, are of the utmost importance as protection measures against the introduction of yellow fever into noninfected places, in which *S. fasciata* are present, but of much less importance in endemically infected areas. They make it necessary to carry out a careful inspection of all passengers arriving from infected places and their observation during the possible incubation period, either in quarantine or by daily inspection.

The protection of nonimmunes against the bites of infected mosquitoes must practically consist in their thorough protection against mosquito bites in general, at any rate during night, as it is the only safe plan in endemic areas to regard all stegomyiæ as infected, and as, in such areas, a very high percentage of mosquitoes are stegomyiæ, which occur together with other mosquitoes. Segregation, living at a distance from the native quarters, can, of course, in some places be useful to a certain extent, but it is by no means an efficient measure. And to pass one's whole time in a screened house or, at any rate, each night from 4 or 5 o'clock in the afternoon to 8 in the morning is a way of living which will soon become insupportable to most people. Therefore, protection of nonimmunes in endemic areas is theoretically a very valuable measure, but practically it is always carried out in a very imperfect way and can not be relied upon.

In order to put matters clear and as a basis for discussion I shall now briefly sum up the measures which I think should be put in force in each of the following three cases: (1) Endemic areas, (2) exposed places, and (3) epidemics in places where yellow fever is ordinarily absent.

Endemically infected places.—In these places all stress should be laid on the eradication of mosquitoes, and as the destruction of adult mosquitoes on a large scale in a whole city is utterly impracticable it follows that all available energy should be directed toward the destruction of larvæ or toward the prevention of mosquitoes depositing their eggs, the previously mentioned measures being carried out officially.

No measures need be taken in the case of running water, but it can not be taken for granted that mosquito larvæ do not thrive in water because it is frequently moved, if it is, on the other hand, left stagnant for a considerable length of time. Thus, larvæ have been found in wells from which water used to be extracted several times a day with a bucket. Also containers which are said to be emptied daily should be looked upon as suspicious. They contain frequently larvæ, which go to the bottom when the container is emptied and remain living in a very small quantity of water until the container is filled again.

These measures can be made obligatory for householders and can be enforced by fines, or they can be carried out by the health authorities. The latter is, I believe, the better plan.

In either case, frequent inspections are necessary in order to make sure of the absence of forbidden collections of water and that oiling and screening are properly carried out. In the case of cesspits it must be remembered that mosquitoes may enter and escape through a pipe outlet, even if several meters long.

These are the principal measures in endemic areas and should, if faithfully carried out, lead to the complete eradication of mosquitoes. Additional measures may be useful, as the detection of cases, their isolation, and fumigation of infected houses; but their importance can not be very great, considering that for each case of typical yellow fever, which always occurs in a foreigner, there are probably tens and very likely hundreds of cases, mostly in natives, which are never detected. Therefore, if the funds available are not unlimited, as they seldom are, it will be more useful to employ all the forces to destroy mosquitoes, and simply exact from practitioners' reports of all suspicious cases, instead of keeping up a costly system of inspectors to visit the residences of foreigners and occasionally detect

a case on the third or fourth day of yellow fever, sometimes later, but very seldom before, and often not at all.

Exposed places should also rid themselves of mosquitoes, so that there would be no danger of spreading should a case of yellow fever happen to be introduced. An exposed place is one where *S. fasciata* is present, and the risk incurred by the introduction of yellow-fever cases increases proportionately to the prevalence of stegomyiæ. If these mosquitoes are completely exterminated the place ceases to be exposed to infection and there need be no measures against the import of cases. But as long as this is not attained the greatest possible care should be taken to avoid introduction of individuals suffering from yellow fever. And in all places where the temperature conditions are favorable for *S. fasciata*, the import of mosquitoes should be prevented by all means.

Antimosquito quarantine consists in careful fumigation of all ships arriving from infected or suspected ports, unless it can be reasonably proved that a ship has not been exposed to the introduction of mosquitoes on board in such a port. As proof of this a certificate might be accepted stating that the ship has remained moored during the whole of its stay at a safe distance, i. e., from 200 to 500 meters, according to the conditions of the harbor, whether open and exposed to wind or closed. For loading and unloading mosquito-proof lighters must have been employed. In the case of screened ships the exemption may be made that it should form no objection that they had been close to the shore or even at a pier, in order to take passengers on board, if all nonscreened compartments, particularly the holds, have been kept carefully closed during that time.

Fumigation should include all parts of the ship. Under no conditions should the holds be exempted, particularly in fruit ships, which are more likely to harbor mosquitoes than any other.

With regard to passengers, they should pass an initial examination, state their point of destination, and sign a declaration that they will report to the local health officer twice daily for two weeks. In the event of any suspicious sign they would be immediately isolated. Passengers arriving in mosquito-proof ships, but not in other ships, might have the number of days since the departure from an infected port discounted from the total of 14.

Several authorities maintain that this observation of passengers is insufficient and advocate the real quarantine system. But when it is considered that Germany, with a large land frontier and immense traffic, has been able to protect herself against importation of cholera from Russia for years, it seems strange that more stringent measures should be necessary in the case of the comparatively limited mari-

time traffic from yellow-fever places to neighboring ports. Another point of importance is also that it presents little difficulty to extend the observation period to a fortnight instead of six days, but it would be nearly impossible to establish a quarantine of 14 days, which must be considered necessary in view of the experience of Marchoux and Simond, that a natural incubation period of 13 days is occasionally observed.

An additional and very important advantage is that this system can be easily applied to all passengers, immunes and nonimmunes. Health authorities are thus saved the discussion of doubtful cases of immunity and the possibility of repeated infections is taken into account.

Thus mosquito-proof ships should have their screened departments exempted from fumigation and their passengers should be allowed a shorter observation period corresponding to the duration of the voyage; other ships should be completely fumigated and their passengers should complete the whole period of observation. A careful mosquito inspection should always be made on screened ships before any exemption is conceded.

In the case of an epidemic outbreak in a nonendemic area the importance of measures is inverted as compared with the conditions in endemic areas. Larvæ destruction and prevention of mosquito breeding take a secondary place; detection of cases, isolation, and fumigation of infected houses, on the other hand, become the principal measures.

Finally, a small number of nonimmunes on expeditions, and in similar cases, should protect themselves as far as possible by segregation and screening.

I believe that the individualizing methods here advocated would be more efficient and cheaper as well as less oppressive than the combined and often more stringent methods which are in use in some places.

There is no time left to discuss classification of ships; I shall only say that in my opinion there is no reason to distinguish between infected and suspected ships; a ship with yellow-fever cases on board constitutes no danger per se; on the other hand, a ship carrying mosquitoes, but with no yellow-fever cases, may be extremely dangerous. It is unjustifiable to declare a ship indemne after 20 days (extrinsic and intrinsic incubation), as there is no guarantee that mosquitoes would always infect individuals on their first day on board, instead of later on; nor can the possibility be excluded that they might remain in the hold during the passage and escape on arrival.

DISCUSSION.

Col. L. M. Maus, Medical Corps, United States Army, chief surgeon eastern division, in his discussion of Surg. White's paper, stated that the crusade against yellow fever was successfully carried out by means of screening with 18-inch mesh and destruction of the larvæ. The troops at Jackson Barracks, that city, were kept in the garrison under quarantine and the post newly screened. Although surrounded by many cases of yellow fever in adjoining city blocks, no case occurred among the troops. Yellow fever moves regularly from house to house, which proves that the stegomyia travels very slowly. During the epidemic in Jacksonville, Fla., in 1877 the physicians noticed this fact, but did not understand the reason. It is possible that the neighbors next door visited the house infected and thus got the disease and transferred it along.

Dr. Eduardo Licéaga, president Superior Board of Health, Mexico: Knowing what are the three requisites for the propagation of yellow fever, to wit, a person suffering of the disease, the transmission of the cause through the bite of the mosquito, and a nonimmune bitten, we found that the disassociation of the three was enough to avert the spread of the disease. The easiest one to disassociate was the patient himself, whom we protected from being bitten by the mosquitoes by isolating him in a room protected with wire screens.

With only this method we succeeded in reducing greatly and finally making the disease disappear from all cities and places except Yucatan, where, due to the existence of unrecognized and unrecognizable cases, we have been and are fighting the mosquitoes themselves by cleaning all pools and stagnant waters and by preserving all water deposits free from larvæ by visiting each dwelling house every 12 days to see that all water deposits are kept free from larvæ.

With this method, together with the isolation of the patient and fumigation of every place where a case occurs, we have stamped out the yellow fever from every place in Mexico, except Yuzatan, and from this place it is now rapidly disappearing.

Capt. Charles F. Craig, Medical Corps, United States Army: I have been much interested in following Dr. Seidelin's work upon his so-called parasite and yellow fever. I have read his publications, and while I have not seen his preparations I have seen his drawings, and presuming that they are accurate representations of the preparations, I must say that I do not believe the objects pictured are parasites. I have had over 12 years of experience with the Romanowsky stains, as Leishman's, Giemsa's, Wright's, and others, in blood work,

and I know that they are full of pitfalls, and preparations stained with them often present appearances in the red corpuscles resembling parasitic bodies. It is therefore necessary to be exceedingly careful in drawing conclusions regarding a supposed parasite stained in blood with these methods. Personally, I believe that Dr. Seidelin's bodies are probably artefacts or due to degenerative conditions in the blood corpuscles, for I have seen similar bodies in the blood of patients suffering from other diseases, especially malaria.

I must take exception to Dr. Seidelin's statement that it is impossible to reduce the number of mosquitoes to a noninfective minimum in cities where yellow fever is endemic. This has been done in Habana, Rio Janeiro, and the Canal Zone, as we all know.

Regarding other statements in the paper, tending to throw discredit upon the results of the Yellow Fever Board, headed by Walter Reed, I would only say that in the fact that this dread disease has disappeared wherever prophylactic measures based upon the results of this board have been enforced, we have an unanswerable proof of the truth of their conclusions.

A. J. Orenstein, Canal Zone: I wish to add to what Capt. Craig said in reference to the possibility of reducing *S. calopus* to a noninfective number. It was done in Panama. Although from time to time a few *S. calopus* can be found here and there, the accidental introduction of a yellow-fever case into the city of Panama has not resulted in a secondary case. This, I think, proves conclusively that at least at the time this case was introduced the *S. calopus* were not sufficiently numerous to give rise to secondary cases.

I say this especially because of Dr. Seidelin's statement that he has been informed that *S. calopus* are not at all uncommon in the Canal Zone.

Prof. Creighton Wellman, New Orleans, La.: I wish to state that if Dr. Seidelin's informant reported for the period I was in the Canal Zone he was mistaken in his facts. While I was in the Canal Zone I sought diligently for stegomyia, and, although an experienced collector, I found neither larvæ nor adults and indeed no other species, although such undoubtedly exist in rural districts.

Dr. H. Seidelin, Liverpool, England: To Dr. White I would say that it is very far from being an impossibility to screen ships—in fact, English shipowners have carried this measure into practice. One firm, the Booth Steamship Co., of Liverpool, first tried the system, as recommended by Dr. Melville-Davison, their medical superintendent, on a single ship, which went far up the Amazon and one of its tributaries. After the ship had made two such voyages without a single case of malaria or yellow fever, a thing which had not

been accomplished before in their experience, they screened all their ships, I believe over 40. Practical people would not go to this very large expenditure, representing thousands of pounds, if they did not find it practicable. (Results published by Melville-Davison in Yellow Fever Bureau Bulletin, 1911, I, 6.)

To Dr. Orenstein I can only say that the information referred to was received from a prominent American health official in the Panama Canal Zone, who wrote to me that they could not possibly have had any cases of yellow fever in the zone, as the disease would then certainly have spread, since they had quite a number of stegomyia.

Capt. Craig and Dr. White seem to have misunderstood what I said about the destruction of adult mosquitoes. I have never said that they could not and should not be destroyed in the case of an epidemic; of course they should. But I have said, and I repeat it, that destruction of adult mosquitoes is of little use in endemically infected areas, where larvæ destruction and abolishment of breeding places are the only rational measures.

Capt. Craig believes that my parasites are artefacts. He has not seen them, and I think we had better delay the discussion until he has. But I may tell him that no authority who has seen my specimens has seriously entertained that idea.

Surg. Gen. Sternberg mentioned the negative results of previous investigations. I have no other answer than this—that negative results nearly always precede a positive one. In this particular case the very great advances in staining technique and construction of microscopes may have helped me to obtain better results than my predecessors.

WEDNESDAY AFTERNOON, SEPTEMBER 25, 1912.

RAPPORT SUR LA PROPHYLAXIE DE LA MALADIE DU SOMMEIL.

MM. A. Laveran et A. Thiroux.

La maladie du sommeil constitue, pour les populations de l'Afrique intertropicale, un redoutable fléau. Endémique depuis longtemps sur un grand nombre de points de la côte occidentale, depuis le Sénégal jusqu'à St. Paul de Loanda, cette maladie a pris, dans ces dernières années, une grande extension au Congo français, au Congo belge, dans l'Ouganda et dans l'Est africain allemand.

Le Haut-Oubanghi et la Haute-Sangha ont été envahis. La région de Carnot (Haute-Sangha), encore indemne en 1906, est aujourd'hui très éprouvée.

Au Congo belge, le Bas-Katanga est atteint.

Dans l'Ouganda, la maladie est nettement envahissante depuis 1896; elle s'est répandue vers le nord, sur les rives du Lac Albert et du bras du Nil qui en sort, jusqu'à Oualdelaï et jusqu'à l'enclave de Lado; vers le sud, dans l'Est africain allemand. Un foyer a été signalé dans la Rhodésia Nord-Est.

De 1905 à 1910, le nombre des décès dus à la maladie du sommeil dans l'Ouganda a été de 25,685; des régions entières sont en voie de se dépeupler.

On croyait naguère que la maladie du sommeil était spéciale à la race noire, il n'en est rien; les blancs s'infectent comme les noirs et, depuis quelques années, le nombre des blancs qui, ayant contracté la maladie du sommeil dans l'Afrique équatoriale, rentrent en Europe pour se soigner n'a pas cessé de s'accroître.

La question de la prophylaxie de cette maladie si meurtrière, si rebelle aux moyens de traitement, s'impose, à l'attention des hygiénistes, et c'est avec raison qu'elle a été inscrite au programme du Congrès.

Nous possédons heureusement, grâce à une série de découvertes d'un très haut intérêt faites dans ces dernières années, des notions très précises sur l'étiologie de la maladie du sommeil. Nous savons que l'agent de la maladie est un trypanosome, le *Trypanosoma gambiense*, qui a été découvert par Dutton en Gambie, en 1902, et dont le rôle pathogène a été bien établi par Castellani, D. Bruce, Nabarro et ensuite par un grand nombre d'autres observateurs; nous savons aussi que le *Trypanosoma gambiense* est propagé par les mouches piquantes connues en Afrique sous le nom de tsétsés et en particulier par la *Glossina palpalis* qui se rencontre toujours dans les localités où la maladie du sommeil est endémique. Une exception a été citée à cette règle: dans la Rhodésia Nord-Est on a trouvé un foyer d'endémicité de la maladie dans des localités où il n'existe que des glossines appartenant à d'autres espèces que *Gl. palpalis*, mais on peut dire que cette exception confirme la règle, car il a été démontré que le trypanosome, agent de cette endémie de Rhodésia, appartenait à une autre espèce que *Tr. gambiense;* Stephens et Fantham ont décrit, sous le nom de *Tr. rhodesiense*, un nouveau trypanosome qui est propagé par les *Glossina morsitans*. Ce foyer de la Rhodésia, peu important jusqu'ici par le nombre des malades, présente cependant, au point de vue prophylactique, un grand intérêt; on doit conclure des faits observés en Rhodésia que les régions dans lesquelles la *Gl. palpalis* n'existe pas, mais où les tsétsés sont représentées par d'autres espèces, et en particulier par la *Gl. morsitans*, peuvent être envahies par la maladie du sommeil, ou du moins par une maladie très voisine.

Les tsétsés ne jouent pas seulement un rôle mécanique dans le transport des trypanosomes; les parasites accomplissent une phase de leur évolution dans le corps des tsétsés, comme l'ont démontré les travaux de Kleine, de Bruce et de ses collaborateurs et de Roubaud. On s'explique ainsi qu'une spécialisation existe entre le trypanosome et la mouche qui le propage, de même qu'entre l'hématozoaire du paludisme et certains moustiques, les Anopheles.

Les glossines s'infectent surtout en suçant le sang des sujets atteints de la maladie du sommeil; on a beaucop accusé le gros gibier de servir de réservoir au virus; la plupart des mammifères sont sensibles au *Tr. gambiense;* les bovidés, les chiens, la plupart des singes, les antilopidés peuvent s'infecter comme l'homme quand ils sont piqués par des tsétsés infectieuses, mais, en fait, il est rare de trouver, dans les pays où la maladie du sommeil est endémique, des animaux sauvages ou domestiques infectés par le *Tr. gambiense;* cela est plus commun pour le *Tr. rhodesiense.*

Certains observateurs ont avancé que des insectes suçeurs de sang autres que les *Glossina*, les Stegomyia notamment, pouvaient transmettre la trypanosomiase; on a réussi quelquefois dans les laboratoires à obtenir des transmissions par le procédé suivant: Un Stomoxys (mouche piquante) ou un Stegomyia (moustique) est placé sur un animal infecté par le *Tr. gambiense;* dès qu'il a commencé à sucer le sang, on le retire et on le porte immédiatement sur un animal sain qui peut s'infecter si l'insecte le pique aussitôt. On se place ainsi dans les mêmes conditions que si on inoculait un peu de sang avec une aiguille ou une lancette, conditions qui diffèrent notablement des conditions naturelles.

Koch et Kudicke ont cité des faits tendant à prouver que la transmission de la maladie du sommeil peut avoir lieu par le coït, et la transmission de l'infection par la voie vaginale a été réalisée chez divers animaux dans quelques expériences de laboratoire; il n'existe aucun exemple avéré de ce mode de transmission chez l'espèce humaine.

La maladie du sommeil a été importée souvent en dehors de l'Afrique, dans des régions comme les Antilles, l'Amérique centrale et le Sud des États-Unis, où les mouches piquantes (autres que les tsétsés) et les Stegomyia abondent; un grand nombre de noirs atteints de la maladie du sommeil ont été transportés autrefois dans ces régions; c'est ainsi que Guérin a pu réunir, à la Martinique (Thèse, Paris, 1869), 148 cas de maladie du sommeil observés en douze ans sur des noirs provenant de la côte occidentale d'Afrique. Malgré des conditions météoriques très favorables en apparence, jamais la maladie ne s'est répandue dans ces régions du globe; on ne peut pas citer un

seul fait de contagion en dehors des zones à tsétsés de l'Afrique intertropicale. La contagion en dehors de ces zones ne deviendrait possible que si des glossines étaient transportées dans des régions favorables à leur développement où elles pourraient s'acclimater.

De ces faits on peut tirer les conclusions suivantes:

Il n'est pas à craindre que la maladie du sommeil se propage en dehors des zones à tsétsés de l'Afrique; la lutte contre cette redoutable endémie peut donc être circonscrite à cette partie du globe. Le nord et le sud de l'Afrique où les tsétsés ne rencontrent pas les conditions favorables à leur existence paraissent être à l'abri du fléau.

La *Glossina palpalis* est l'agent ordinaire de propagation du *Trypanosoma gambiense*, mais d'autres espèces de glossines peuvent sans doute la suppléer; la *Glossina morsitans* propage le *Trypanosoma rhodesiense*.

De même que pour le paludisme, la prophylaxie doit s'adresser ici, d'une part à l'agent de propagation, d'autre part aux malades qui constituent le principal réservoir de virus pour la trypanosomiase, le seul pour le paludisme.

1. MESURES AYANT POUR BUT DE DÉTRUIRE LES GLOSSINES OU DE METTRE L'HOMME À L'ABRI DE LEURS PIQÛRES.

Les glossines ont besoin pour se multiplier de terrains humides protégés par la brousse; *Glossina palpalis*, en particulier, s'éloigne peu des rives boisées des cours d'eau et des lacs; ses larves et ses pupes, déposées dans le sol, meurent quand, par suite de la disparition de la brousse, elles se trouvent exposées aux ardeurs du soleil (Roubaud).

Les auteurs sont unanimes pour constater que le débroussement est une des mesures les plus utiles que l'on puisse prendre contre les glossines. La brousse sera détruite dans un rayon de 2 kilomètres environ autour des villages, des postes ou résidences, des factoreries; aux abords des places où les indigènes viennest puiser l'eau ou laver le linge, aux points d'amarrage des pirogues ou d'escale des bateaux, aux abords des ponts et des gués, sur les routes fréquentées, le long des voies ferrées.

Au Congo belge, 31 brigades sanitaires comprenant 1,680 hommes sont employées au débroussement et au déboisement.

Le débroussement par le feu a l'inconvénient de faire disparaître les arbres en même temps que la brousse; il est préférable de débrousser à la main en épargnant les arbres à partir de 4 mètres de hauteur; les arbres ébranchés jusqu'à 3 mètres au-dessus du sol peuvent être conservés sans inconvénient, à la condition de n'être

pas trop serrés. La brousse et les arbustes coupés et desséchés seront brûlés sur place, là où il n'y aura pas d'arbres à ménager.

Il est indiqué de combler les mares inutiles, à proximité des villages, et de mettre à la disposition des indigènes des puits d'un accès facile, afin qu'ils ne soient pas forcés d'aller puiser l'eau dans des marigots ou des cours d'eau sur les bords desquels pullulent les glossines.

Des villages situés sur les rives de cours d'eau ou de lacs infestées par les *Gl. palpalis* ont été souvent abandonnés, soit spontanément par les indigènes, soit par mesure sanitaire, sur l'injonction des autorités européennes. Les villages des indigènes de l'Afrique intertropicale sont vite reconstruits, et à peu de frais. On choisit naturellement les nouveaux emplacements in dehors des zones à *Gl. palpalis.*

Dans l'Ouganda, la population indigène d'un grand nombre de localités a été déplacée dans ces dernières années; c'est ainsi que les îles Sese (lac Victoria) ont été évacuées; pendant l'année 1909, 24,000 personnes ont été éloignées des localités infestées par les *Gl. palpalis.* Grâce à cette mesure, et au déboisement largement pratiqué, la mortalité par maladie du sommeil a beaucoup diminué dans l'Ouganda. Dans le Buganda, le chiffre des décès par cette cause qui, en 1905, avait été de 8,003, est tombé, en 1909, à 925; en 1910, il a été de 1,546.

Le déplacement des villages indigènes situés sur les cours d'eau ou à proximité des lacs présente cet inconvénient que les localités évacuées ne s'assainissent pas; elles sont envahies par la brousse, le gros gibier qui peut servir de réservoir au virus s'y multiplie, et les glossines y pullulent en liberté. Dans ces conditions, il est difficile de réoccuper les localités abandonnées, alors que ces localités, situées sur des cours d'eau ou sur des lacs, présentent au point de vus économique de grands avantages, les transports par eau étant d'une grande utilité dans des pays où il n'y a pas de routes. C'est là une considération dont on doit tenir compte.

La destruction du gros gibier aux environs des agglomérations est indiquée; le gros gibier, les antilopes notamment, pouvant servir de réservoir au virus.

Koch a recommandé de détruire les crocodiles dont le sang sert à la nourriture des glossines.

On a songé à recourir aux ennemis naturels des glossines. Picard a fait connaître un hyménoptère du genre Oxybelus, chasseur de glossines au Soudan français; E. Roubaud, un Bembex (guêpe), chasseur de glossines au Dahomey. Les essais d'élevage de ces insectes n'ont malheureusement pas réussi.

Minchin a recommandé l'introduction, dans les pays à tsétsés, de la poule de brousse (jungle fowl) qui détruit les pupes de ces insectes; ce conseil nous semble bon.

Maldonado a préconisé l'emploi de la glu pour la destruction des glossines; on a utilisé, dans la même but, le latex de Loranthus, de Ficus et d'Euphorbiacées. Dans les localités où abondent les glossines, on tend des toiles de couleur sombre enduites de glu ou, mieux, on garnit une partie du corps d'animaux domestiques (chèvres, ânes) ou de travailleurs indigènes avec des morceaux d'étoffes noires enduites de glu. Ce procédé a été employé avec un certain succès à l'île Principe et au Nyasaland.

Les moyens de protection mécanique qui rendent de si grands services dans la prophylaxie du paludisme peuvent être utilisés contre les glossines, au moins par les Européens dont les habitations se prêtent à l'installation de toiles métalliques. La protection mécanique n'est, malheureusement, pas applicable aux huttes mal closes des indigènes.

Les voiles qui protègent la tête et la nuque, et les gants qui protègent les mains, sont difficilement supportés dans les zones à tsétsés à cause de la grande chaleur qui y règne.

Sur les bateaux qui font le service des lacs et des cours d'eau dont les rives donnent abri aux tsétsés, il est indispensable d'avoir des réduits protégés contre l'accès des mouches, et cependant bien ventilés, afin que les passagers n'hésitent pas à en faire usage.

La protection mécanique doit être employée aussi pour les railways qui traversent des régions infestées de glossines.

Les tsétsés ne piquant que le jour, il est indiqué de voyager pendant la nuit dans les pays où elles abondent; pour la paludisme, l'indication est inverse, les Anopheles ne piquant que le soir et la nuit.

Les tsétsés s'attaquent plus souvent aux personnes qui ont des vêtements de couleur sombre qu'à celles qui ont des vêtements blancs; il est donc indiqué de porter, dans les pays à tsétsés, des vêtements blancs ou de couleur claire.

On ne connaît pas de procédé de vaccination efficace contre la trypanosomiase humaine, on ne connaît pas non plus de médicament qui puisse être employé sans danger préventivement, d'une façon suivie, comme l'est la quinine dans la prophylaxie du paludisme. L'acide arsénieux n'a pas d'action préventive dans les trypanosomiases.

Lorsque, au cours d'un voyage dans une région où la trypanosomiase est endémique, on a été piqué par les tsétsés, il est prudent de faire une ou deux injections d'atoxyl; cette précaution s'impose quand les piqûres sont le siège de douleurs persistantes accompagnées de rougeur et d'œdème de la peau.

II. MESURES AYANT POUR BUT D'EMPÊCHER LES SUJETS ATTEINTS DE TRYPANOSOMIASE DE PROPAGER LA MALADIE.

Il n'est pas douteux que l'expansion actuelle de la maladie soit due, pour une grande part, aux changements qui se sont produits dans la manière de vivre des indigènes depuis que les Européens ont pris possession des vastes régions, à peine explorées naguère, de l'Afrique intertropicale. Autrefois chaque peuplade vivait à part, les indigènes se déplaçaient peu; aujourd'hui les trafiquants et leurs serviteurs, les porteurs, les soldats et les travailleurs indigènes, passent sans cesse des régions infectées dans des régions encore indemnes et les contaminent. Il est urgent de prendre des mesures sévères pour empêcher les sujets atteints de trypanosomiase de propager la maladie.

Dans les régions où la maladie du sommeil est déjà endémique, une excellente mesure consiste à créer des camps ou des villages dans lesquels les malades sont réunis et traités. Ces camps ou villages de ségrégation, qui isolent les malades de la population saine, ont rendu de grands services dans l'Ouganda, dans l'Afrique occidentale allemande, au Congo belge, au Congo français, au Sénégal.

Dans l'Ouganda, des camps de ségrégation ont été installés à Chagwe, à Busiro et à Busoga. En l'espace de quatre ans, 7,209 malades ont été traités dans ces camps.

L'Afrique orientale allemande possède 6 camps de ségrégation pour les indigènes atteints de la maladie du sommeil.

Deux camps ont été installés au Nyasaland.

Au Congo belge, 27 lazarets ou villages de ségrégation ont été créés.

Au Congo français, outre l'hôpital de Brazzaville, un village de ségrégation pour les indigènes atteints de trypanosomiase a été installé, en 1910, par la Mission de la maladie du sommeil.

Dès 1908, un village de ségrégation a été créé au Sénégal, d'après les plans et sous la direction du Dr. Thiroux.

En 1912, un village de ségrégation a été créé à la Côte d'Ivoire, aux environs de Koroko.

Pour installer les camps ou villages de ségrégation, il faut choisir des localités qui ne sont pas infestées de glossines et en particulier de *Gl. palpalis;* les plateaux un peu élevés, suffisamment éloignés des lacs ou des cours d'eau, conviennent très bien, après un débroussement méthodique.

On évitera tout ce qui ferait ressembler le village de ségrégation à une prison; on s'efforcera au contraire de procurer aux malades tout le bien-être possible, afin que les indigènes, loin de fuir ce village, demandent à y être soignés. Les cases seront du modèle local et on

procurera aux malades la nourriture qu'ils préfèrent; on n'oubliera pas qu'une alimentation abondante est un adjuvant excellent du traitement de la trypanosomiase. Un ou plusieurs médecins seront chargés de traiter les malades et de surveiller l'hygiène générale.

Lorsqu'il n'est pas possible d'éloigner les malades des agglomérations dans lesquelles ils se sont infectés, il est indiqué de les réunir dans des cases un peu écartées et de les soumettre à un traitement qui aura pour effet de faire disparaître les trypanosomes du sang et de diminuer, par suite, les dangers de contagion.

Il importe que les malades soient traités aussi rapidement que possible, afin qu'ils ne puissent pas transmettre la trypanosomiase, et aussi dans leur propre intérêt, la maladie étant plus facilement curable à la première période de son évolution qu'à la seconde. Des médecins seront chargés de passer des visites dans les villages indigènes et les chefs de ces villages seront tenus de signaler ceux de leurs administrés qui présenteront des signes de la maladie du sommeil, en particulier des adénites cervicales.

Un décret de 1906 qui a organisé, au Congo belge, les chefferies indigènes, rend le chef de chaque village responsable de l'exécution de toutes les mesures intéressant l'hygiène: c'est là une mesure excellente qui devrait être appliquée dans toutes les colonies africaines et qui rendrait, en particulier, de grands services dans la prophylaxie de la maladie du sommeil; le concours des chefs indigènes est indispensable, non seulement pour faire connaître les malades, mais aussi pour les opérations de débroussement, de comblement des marigots, etc.

Dans les régions où la trypanosomiase est endémique, il est nécessaire de faire connaître aux habitants les mesures qu'ils doivent prendre pour se protéger contre la maladie. On distribuera aux Européens des notices donnant des indications simples et pratiques sur la maladie du sommeil, sur ses causes, sur son mode de propagation par les tsétsés et sur sa prophylaxie:[1] les instituteurs seront chargés de donner à leurs élèves les notions indispensables. On s'efforcera de renseigner les indigènes par l'intermédiaire des chefs des villages.

Afin d'empêcher l'extension de la maladie dans des régions encore indemnes, il est indispensable de prendre une série de mesures dont les plus importantes peuvent être résumées comme il suit:

Eviter que les soldats indigènes, les porteurs, les boys, les courriers, qui ont été recrutés dans les pays où la maladie du sommeil est endémique, soient envoyés dans des pays encore indemnes.

Exiger des travailleurs indigènes qui passent d'une région dans l'autre, des certificats de santé, délivrés depuis moins d'une année.

Créer des postes d'inspection sur les voies de communication les plus fréquentées (voies de terre et voies fluviales), de manière à interdire aux malades atteints de trypanosomiase l'accès des régions indemnes ou faiblement infectées.

Dutton et Todd ont insisté avec raison sur l'importance de cette dernière mesure; ils ont recommandé d'examiner spécialement, dans les postes d'inspection, les sujets atteints de polyadénite lymphatique; des règlements conformes aux idées émises par ces observateurs ont été adoptés au Congo belge, où 17 postes d'inspection ont été créés, et au Soudan anglo-égyptien, sur les frontières congolaises.

Pour lutter efficacement contre la maladie du sommeil, une entente entre les Gouvernements intéressés serait nécessaire.

Une conférence internationale réunie à Londres, au mois de juin 1907, avait élaboré un projet d'entente pour la lutte contre la maladie du sommeil; malheureusement ce projet a soulevé des difficultés diplomatiques et il a été abandonné.

La pratique n'a pas tardé à montrer l'utilité des mesures préconisées par la Conférence de Londres. Des arrangements ont été conclus par plusieurs Gouvernements, mais ces arrangements particuliers ne remplacent que très imparfaitement le plan d'ensemble qui avait été conçu et auquel il faudra revenir, croyons nous.

En 1908, l'Allemagne a signé, avec la Grande-Bretagne, un arrangement relatif à la prophylaxie de la maladie du sommeil.

Les mesures à prendre dans la Rhodésia et au Katanga ont été l'objet d'une entente entre la Grande-Bretagne et la Belgique.

Les gouverneurs généraux de l'Afrique équatoriale française et du Congo belge ont pris, de concert, des mesures pour empêcher les indigènes atteints de la maladie du sommeil de passer d'une de ces colonies dans l'autre.

La lutte contre la maladie du sommeil est engagée partout dans l'Afrique équatoriale. Des missions allemandes, anglaises, belges, françaises, portugaises ont été envoyées dans les pays les plus éprouvés pour étudier la maladie et les moyens de la combattre; les sociétés de médecine tropicale, créées de tous côtés dans ces dernières années, ont mis la question à leur ordre du jour et ont élaboré des programmes pour la lutte à entreprendre; [2] dans toutes les colonies intéressées des arrêtés ou des règlements sanitaires ont prescrit les mesures à prendre; [3] des résultats partiels ont déjà été obtenus, mais une direction générale fait défaut pour coordonner les efforts et les rendre plus efficaces; nous estimons que cette direction générale ne sera obtenue que par une entente des Gouvernements intéressés.

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[3] Des semblables notices ont été distribuées au Congo belge et dans les colonies anglaises de l'Afrique tropicale par le Sleeping Sickness Bureau of the Royal Society et, au Congo français, par la Mission française de la maladie du

sommeil. Le Dr. Thiroux a fait distribuer aux administrateurs commandant les cercles du Sénégal et aux instituteurs des spécimens de *Gl. palpalis* avec des notices sur la maladie du sommeil et sa prophylaxie.

[2] Voir notament le rapport de MM. Laveran et Kermorgant à la Société de pathologie exotique, rapport dont les conclusions ont été votées par la Société. (Bull. de la Soc. de path. exotique, 1908, t. I, p. 319.)

[3] On consultera avec intérêt le règlement coordonnant les mesures prises au Congo belge pour enrayer la maladie du sommeil (Imprimerie du Congo belge à Boma) et les arrêtés concernant la maladies du sommeil en vigueur dans l'Afrique équatoriale et dans l'Afrique occidentale française. (Bullet. de la Soc. de path. exotique, 1911, t. IV, p. 505, et 1812, t. V, p. 2.)

THE TREATMENT OF TRYPANOSOMA INFECTION BY MEANS OF CERTAIN PIGMENTS ORALLY ADMINISTERED.

Prof. Dr. Ludwig Brieger (Berlin).

It has already been stated by us in an earlier communication that bodies of the Saffranin group possess a specific trypanocidic effect. The experiments were continued by Dr. Krause, my collaborator many years in colonial research, and myself, the results of which will now be given.

Krause and Weber discovered in my institute in 1907 that the trypanocidic action of certain pigments loses this specific effect or that it becomes more pronounced, just according as the molecule is formed; that is to say, one may, by addition or taking away of groups in the lateral chain, either increase or decrease the effect. We were enabled to carry on these observations further in a most excellent manner with the substances below mentioned.

Let it, however, be said beforehand that the pigments first employed have other qualities as well, namely, a specific effect against trypanosoma, but that this effect is of a transient character. The trypanosoma disappear out of the blood, but reappear after 6 or 8 weeks and the cure is therefore only an apparent one.

From this it can be deduced that the substances which up to now have been incorporated with the animal body have been too quickly split up.

It would appear therefore probable that all these different substances work only upon the trypanosomen situated in the blood circulation, while those in the organs and tissues hold parasites concealed which are not reached by the remedy.

It has therefore been our endeavor to discover substances not easily split up and nonoxygenized which will permeate all the organs. As

a matter of fact we have discovered and have reported such substances, as has already been related. In the course of these investigations a very large number of bodies belonging to the safranin and eurhodin groups—some of them new—were taken and biologically examined. Only well-characterized substances possessing especially strong trypanocidic effects and containing in their molecules the combination of 3 and 5 nitrogen were given by mouth. These substances are capable of great resistance against disintegration and may be made absolutely nonpoisonous by chemical purification. A man can take up to 30 grains, in doses of from one-quarter up to 1 grain per diem, without any injurious effect, as the substances are absolutely free from arsenic. But in practice only 0.1 to a maximum of 0.3 per diem is required. Here we have proof that organic bodies need not necessarily be coupled with arsenic in order to bring the trypanosoma substance to the cells. The infection of animals was carried on with *trypanasoma brucii* by means of four different varieties of the same stock. Firstly, with Hamburg stock, out of the Institute for Tropical Hygiene (Nocht); secondly, with Koch stock, out of the Koch Institute, Berlin; thirdly, with strong arsenic stock out of the local veterinary school; and, fourthly, with Mesnil stock, out of the Pasteur Institute, Paris.

Although the trypanosomen were morphologically of different kinds with regard to the size the success of our remedy was in all cases good. It may here be mentioned, too, that all our experiments with rats and guinea pigs met with the same degree of success. Thus, often from 12 to 20 rats were infected and fed with the preparation. With two exceptions the animals thus fed were always cured and freed from trypanosomen. At the present time we have series of rats, infected last November and December and fed on the preparation, which are to-day alive and free from trypanosomen, although the feeding with the preparation has ceased for months.

The time of such feeding lasted from four to six weeks. The food for rats was composed of soaked bread, while that of guinea pigs was soaked wheat husks, well mixed with the pigment and so kneaded that the whole was one homogeneous mass.

In addition to this the animals were fed with nourishing food every second day without the pigment. For a rat or guinea pig about 0.05 gram up to 0.1 gram of the substance was used. The results obtained from guinea pigs were equally good. Rats which had been freed from trypanosomen for months were reinfected with more difficulty than originally infected ones, and the infection in the former could be more easily removed than in the case of the newly infected ones.

The rats were fed with the substance at once, as well as 24 hours after infection, when the blood became more or less flooded with trypanosomen by its means. Here it was proved that all substances are not equally advantageous to use. Some substances possessing really good trypanocidic properties—the molecules of which, however, were a little changed—when given to rats more than 24 hours after infection could not, in consequence of the slightly changed molecules, any longer destroy the trypanosomen in time to prevent death.

Since guinea pigs live longer after infection with trypanosoma than rats (our stocks killed rats in from 48 to 72 hours), we have been working especially with them during the last few months, as the effect of the remedy on the inner organs is easier to determine in their case. As regards virulence it may be mentioned that it is not of equal importance in infection if the blood be taken from the tail or if an infected rat be killed and the whole of the heart's blood be used for purposes of infection.

With the best substances we can save guinea pigs 6 days after infection and 24 hours before death by one single dose; that is to say, we can free them from trypanosoma and permanently cure them by further doses. Those that are not treated with the substance die on the seventh day.

We tried using serum of animals which, although not infected, had been fed for some weeks with the best trypanocidic pigments. For example, a dog was so fed, and after it had had about 50 grains of the substance blood was taken from it and injected into infected rats. As was, however, to be expected, no protective or healing effect was observed.

Observations are already being carried on in German, English, and Belgian colonies against the tsetse fly in cattle and sleeping sickness in man with an especially good and presumably effective substance produced as the result of special experiments. This we call trypasafrol, but up to the present we do not know with what results it has been attended.

We are also engaged in testing these substances with changes of their molecules, as well as coupled with metals and metalloids in other diseases of infection and of metabolism.

THE PREVENTION OF HUMAN TRYPANOSOMIASIS IN AFRICA.

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No completely efficient method is known by which human trypanosomiasis can be entirely prevented, although there are several factors concerned in its spread through which the extension of the disease can be delayed. A discussion of its prevention is, consequently, at once divided into two parts: First, a statement of the measures, based upon present knowledge, which may be employed by administrators to hinder its extension, and second, a consideration of the lines of inquiry which should be followed in the study of the disease, for the purpose of finding means by which it may be entirely prevented.

Human trypanosomiasis is caused by the presence in human beings of a trypanosome introduced into them by the bites of an insect. Consequently, each of the two headings into which a discussion of the prevention of the disease is divided must consider the host, the parasite, the fly, and the relations of each of these agents with the others.

It has long been known that persons much exposed to the bites of tsetse flies, *Glossina palpalis*, in particular, were especially liable to become infected by trypanosomes, and the importance of preventing these flies from biting people has been apparent. *Glossina palpalis* thrives only near water, so waterside villages should often be moved to higher, fly-free ground, and activities, such as fishing and rice farming, which require water, must often be interrupted by the depopulation of the areas in which they are carried out. It has been found that *Glossina palpalis* will not remain in areas which have been cleared of thick vegetation; they require a humid atmosphere and shade. Consequently a cleared space measuring 200 to 400, or better, 600 yards in width, should surround every ford, wharf, house, or other place frequented by people and situated in a neighborhood where *Glossina palpalis* exists; water for domestic purposes should be obtained from wells rather than from streams. Most tsetse flies will not bite at night; therefore, if it is absolutely necessary to pass through an area where they exist the journey should be made, as far as possible, after dark.

It is now certain that human trypanosomiasis may be transmitted by varieties of tsetse flies other than *Glossina palpalis* and that it may even be carried, though probably rarely, by biting flies of other genera. The bites of all flies, particularly tsetse flies, are therefore dangerous. Many biting flies can not be avoided by avoiding water, because its proximity is not a necessity for them. Other means of avoiding their bites must be followed. Fly-proof screens for buildings and conveyances, such as steamers, canoes, and trains, are often useful. Clothing, including veils and gloves, gives considerable pro-

tection from fly bites; the clothes should fit loosely and be white, for tsetses will settle on dark-colored garments rather than on white ones. Europeans forced to pass through places infested by tsetse flies will find it worth while remembering that they are much less likely to be bitten if natives are near them and if they make little movement. None of the substances with which it has been proposed to cover persons to make them repellant to tsetses are efficient; the oils of citronella and eucalyptus seem to be the best of them.

From what has been said, it is obvious that there is no perfect method of preventing people from being bitten by tsetse flies in districts where they exist, nor is there any method of exterminating them; but the flies can not give trypanosomiasis by their bites unless they have previously ingested trypanosomes. The importance of preventing the entrance into uninfected districts of trypanosomes contained in the blood of infected persons or animals is evident.

The history of the spread of human trypanosomiasis shows that it extends slowly from an infected center, but that it may be carried very rapidly for long distances by infected persons. The disease is most virulent among populations newly subjected to it. The opening up of Africa has made travel infinitely easier and considerable numbers of men quickly move long distances in a way that was impossible a few years ago. Much of the extension of human trypanosomiasis seems to be directly due to the increased movement of individuals about Africa—the first cases in a newly infected district always appear along the trade routes; consequently transportation must be controlled to prevent the carrying of the disease into uninfected areas.

The application of such control is exceptionally complicated by the difficulty of recognizing the disease. Infected persons may remain in apparent health for years. At present the disease can only be definitely recognized by a demonstration of the parasite's presence, and in early cases, or even in advanced ones with marked symptoms, it is often difficult to do so. The parasites are usually found by the microscopical examinations of body fluids and tissues. The most efficient order of examination for diagnosis is gland juice, blood, cerebrospinal fluid, and other materials. As a rule the parasites will be found most easily and most quickly in the gland juice.

An enlargement of the lymphatic glands is an early feature of human trypanosomiasis. Although it may appear late in some cases, and although the glands may become small when the disease is far advanced, it is a very constant sign; and, though it may not be so valuable a sign in Rhodesia, in some parts of West Africa it is wise to assume that every native with enlarged posterior cervical glands has trypanosomiasis until the contrary has been proved. It is believed that in West Africa a very large proportion of the cases of

trypanosomiasis existing in a population will be detected by examining gland juice taken from the glands of natives selected because of grandular enlargement. The method will sometimes fail in the examination of late cases, in whom the diagnosis is almost certain from the symptoms; it will also fail to detect a percentage of very early cases. How great that percentage may be is uncertain, but it is not thought to be large. At present such cases can only be detected by more expensive methods; that is, by repeated microscopical examinations and by the inoculation of blood into susceptible animals.

Examination by gland puncture constitutes a cheap and easily applied method by which a very large proportion of West African natives infected by trypanisomiasis may be detected. It should therefore be of much assistance in furnishing a basis for diagnosis to be used in applying measures designed to prevent the entrance of infected persons into areas where human trypanosomiasis does not exist. It would be well if all interchange of population between infected and uninfected districts were prevented. If movement between such areas is inevitable, it will often be desirable to control it by a system involving passes and periodically renewable health certificates to insure that those who travel are uninfected. Infected persons found in uninfected districts should not be allowed to remain there; the employment or introduction of infected labor among uninfected persons should be severely punished. It is often advisable to collect infected persons into segregation villages. These villages are situated in places where there are no flies, and their absence is made doubly certain by surrounding the villages by cultivated fields planted with sweet potatoes, groundnuts, beans, or some other low-lying crop, which will not shelter the flies as do, for example, manioc bushes. Such villages should be largely self-supporting, for many early cases, even if untreated, have several years of capability for hard work before them. The occupations of the infected inhabitants of these villages should not expose them to fly bites; work that does should be done by the uninfected persons who would inevitably accompany some of the patients. Each village must be under the immediate control of a competent European, in order that the best living conditions may be insured for those inhabiting it and that it may be a model for neighboring natives. The gradual education of natives in healthier methods of living in their environment may be made one of the strongest factors in securing a permanent reduction in the incidence of human trypanosomiasis. Although the reports of the results of treatment in segregation camps are discouraging, a small percentage of the early cases treated seems to have been cured, and many natives have been temporarily benefited. The results of the treatment of Europeans makes it quite certain that many cases of trypanosomiasis can be

cured if they are treated energetically early in the disease. The sodium salt of para-amido-phenyl-arsenic acid (atoxyl), or compounds allied to it, and antimony remain the most efficient trypanocides. Each drug must be given in full doses, and it should be alternated with other trypanocides. Good food and good general treatment are essential.

Many wild animals and all domestic ones can be infected with the human trypanosome. It will therefore probably be wise to destroy all wild animals near settlements, to make certain that domestic animals are uninfected and, by protecting them from fly bites, to prevent their infection.

It seems certain that more than one variety of trypanosome may infect Africans. The methods of preventing infection by them are the same for all, though the details of applying those methods may vary.

A means of exterminating tsetse flies is not known. *Glossina palpalis* requires shady, humid spots for itself and for the development of its pupæ. If these conditions be eliminated by the removal of undergrowth and the places where they existed be cultivated, *Glossina palpalis*, and to a lesser extent other tsetse flies, will leave them, and it is believed that they will not return. Those flies which are sometimes seen at the center of a clearing of four or more hundred yards in width are either casual immigrants or, more usually, have followed a person or an animal coming from the surrounding uncleared area.

All of the tsetse flies reproduce very slowly, and it was hoped that their numbers might be considerably reduced by the destruction of adults. The continued daily catching of tens or scores of flies over a period of several months has apparently not lessened their numbers in several places, but in others it has been claimed that the flies have been very considerably reduced by catching large numbers of them on traps composed of sheets of black cloth covered with birdlime, which were hung on the backs of field laborers. Tsetse flies, *Glossina palpalis* especially, often rest in sheltered places on steamers and are carried for long distances; they may be carried by trains also. The danger of introducing them thus into districts where they do not exist is apparent; it should be obviated.

The preventive measure indicated in this paper are practically those outlined by the Liverpool school in 1907 and before. Now, as then, it is insisted that since there is no efficient method of treating the diseance, and since contact between flies capable of transmitting the trypanosomes and men can not be prevented completely, every effort must be taken to prevent the introduction of the parasites contained in infected persons or animals into uninfected districts. The object of this paper, like that of its predecessors, is merely to

suggest the measures by which sleeping sickness may be prevented. The determination of the precise way in which those measures ought to be applied is left to those who must administer them. Any discussion of their application is useless without complete knowledge of the conditions existing in the locality where they are to be enforced. Measures applicable in one situation may be unfitted for another. For example, the establishment of segregation villages would be useless in certain heavily wooded parts of the Kongo Free State, where tsetse flies are ubiquitous and most of the natives are infected; but they might be very useful in the British colony of the Gambia, where fly-free areas exist and the percentage of infected natives is small. Again, in the Gambia most of the villages are well placed at some distance from the water; it would be superfluous to move them; many natives travel into the colony—they usually come from uninfected localities and they enter the colony by so many points along an exceedingly long frontier that an examination of all travelers coming in would be almost impossible, but in the Kongo the transplantation of villages and the supervision of much traveled trade routes are important and applicable measures.

It is again insisted that measures intended to prevent sleeping sickness must be administered by a properly trained and numerically adequate corps appointed for that purpose. It should consist of a head and assistants, who must be well-trained medical men, and of a strong force of clerks, orderlies, inspectors, and interpreters. It is essential that the native members of the corps should be tactful and liked by the native populations among which they work. The work of the corps can only be effective if it be supported by appropriate legislation and be adequately financed. Considerable executive power must reside in its head, and the whole staff must work in closest connection and sympathy with the administration and services, such as the police and medical services, of the area over which it watches. Its plans must be inspired by a thorough knowledge of local conditions, and they must be definite, well-organized, and coherent in all their details; the actions of the corps must be uninterrupted, "prompt, bold, and decisive."

An essential preliminary of a serious attempt at prevention must always be a careful survey and mapping of the people, infected and uninfected, and of biting flies existing in the area under consideration. The search for infected persons must be thorough. Those making it must enter the huts in search of cases, and they must never forget the frequency with which insane natives have been found to be suffering from trypanosomiasis. It is evident that the search can scarcely be successful without the cooperation of the chiefs and the good will of the natives. Every effort must be made by the doctors traveling through the country to avoid frightening the natives and

to convince them that the measures taken are reasonable, worthy of support, and for their good. The necessity for tact in both the Europeans and native assistants engaged in survey work is evident.

The usual distribution of the biting flies in a given area can only be determined by several seasons' work and the increase or diminution in the amount of human trypanosomiasis present can only be determined by a repeated census of the natives; consequently the survey, once commenced, should be maintained for some years.

A review of the present situation leads to the conclusion that there is no single means by which human trypanosomiasis can be prevented, but that there are several methods by which it can be combated. It is probable that a union of these methods, in well-administered preventive measures, will insure a comparatively complete control of the disease in some districts. And since the influences which achieve this control—clearing, absence of flies, good living and medication—are those resulting from the opening up of the country, it is confidently expected that as settlement advances the prevention of human trypanosomiasis will become progressively easier. The measures proposed must always be chosen after careful consideration of the conditions existing in the locality in which they are to be enforced. Lack of funds and other economic considerations will often tend to prevent administrators from initiating the most effective measures of prevention. Against the cost of the measures must be weighed the ruinous losses which they are intended to prevent.

The large amount of research work which has been done on human trypanosomiasis during the past five years has greatly increased our knowledge of the infection, but it has not added very materially to the means by which it may be combated. Much remains to be learned concerning trypanosomiasis and further investigation should result in strengthening our means of fighting it.

Work on the nature of the relative active immunity which sometimes exists in animals and men and on the questions connected with immunity should be fruitful. A knowledge of the reasons which occasionally prevent the rapid spread of human trypanosomiasis in localities where every factor necessary for its extension seems to be present, might indicate new methods of prevention. More should be known concerning the later history of cases of chronic human trypanosomiasis, of the exact way in which trypanosomes harm their hosts, of the existence of a toxin produced by trypanosomes, of the mechanism of susceptibility and spontaneous cure, and of the possibilities of serum diagnosis and vaccination. Better methods of diagnosis and treatment, especially, are badly needed. Is there always a local reaction at the site of an infecting bite, and when one occurs will excision prevent infection? Perhaps because the results have not been always encouraging the search

for an efficient treatment of trypanosomiasis by drugs has become less active; the value of the trypanocides which have been found already should be sufficient warrant for continuing the search for still more efficient ones, both in the laboratory and in the field.

Little is still known of the bionomics of trypanosomes; a knowledge of the factors which produce alterations in their virulence and morphology might be advantageous. Accurate knowledge of all the living beings, of whatever species—animals, reptiles, birds, or insects—which may be hosts for the trypanosomes and of the condition and development of the parasites while dependent on them is needed. An unexpectedly large percentage of large wild mammals—game—has been found to harbor trypanosomes capable of infecting human beings. More careful experiments have shown that the tsetse flies, which were once held by some persons to be merely immediate mechanical transmitters of trypanosomes, can, under certain unknown conditions, transmit these parasites when an interval of 20 or more days elapses between the feeds at which the trypanosomes are received and transmitted. Exact knowledge of the nature of the development followed by the trypanosomes in the tsetse fly and of the insects in which development may exist is urgently required. It has already been shown that insects other than tsetse flies may mechanically transmit trypanosomes capable of infecting human beings.

The success which has attended attempts to prevent malaria by killing the mosquitoes which transmit it creates a natural impulse to attempt the prevention of human trypanosomiasis by destroying the flies which transmit it. Unfortunately, our present knowledge of the bionomics of tsetse flies does not afford us methods of doing so completely; it is possible that increased knowledge may. Very little is known of any of the tsetse flies. Knowledge concerning the following points in particular is much needed for all of them: Their distribution, especially why tsetses, though occurring in the neighborhood, are sometimes very persistently absent from localities apparently suited to them; their migrations and the influences determining their local increase and decrease in numbers; their seasonal variations; their natural enemies, both rapacious and parasitic; their food; the whole story of their reproduction in nature; the possibility of using traps for the destruction of adult flies.

Research on these points can only be successful if it is attempted by enthusiastic and well-equipped entomologists and if not one but several seasons are devoted to the work.

The governments of the areas in which human trypanosomiasis occurs have already done much to apply the preventive measures suggested by existing knowledge of the disease and to support studies from which more efficient measures might result. In the application

of preventive measures the good understanding which ensures complete international cooperation must be preserved. The free interchange of information concerning the measures applied, the researches undertaken, and the results of both must continue; the publication of an annual report should be part of every body engaged in the prevention of human trypanosomiasis. In this connection the great value of the Bulletin of the Sleeping Sickness Bureau is obvious; no references to original publications are given in this paper, because they can be found so easily in that Bulletin.

The recent spread of human trypanosomiasis has largely resulted from the coming of Europeans to Africa; changed conditions which will result from this continued occupation of tropical Africa will probably do much to limit the extent of the disease. For example, railroads make unnecessary the passage of large bodies of carriers, by whom infection has often been carried, from infected to uninfected districts.

In conclusion, it is repeated, human trypanosomiasis can be controlled in many parts of Africa by the energetic application of existing methods of prevention, and it is not improbable that continued research will result in the discovery of more efficient ones. Wherever it is possible permanent methods of prevention such as deforestation and education of the natives should be employed in preference to temporary ones such as the depopulation of a district.

IMMUNIZATION BY MEANS OF CULTURES OF TRYPANOSOMA LEWISI.[1]

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In a previous paper [2] it was shown that cultures of *Tr. lewisi* when plasmolyzed in collodium sacs, against distilled water, underwent changes resulting apparently in complete solution or rather disintegration of the organism. Three or more injections, on alternate days, of such plasmolyzed cultures protected young rats against a minimal infective dose of virulent blood. Immunity could therefore be produced by the injection of disintegrated cultural trypanosomes.

At the time it was also pointed out that cultures of *Tr. lewisi* and *Tr. brucei*, even after they had passed through a hundred generations or subcultures, in the course of two years, do not become attenuated by such prolonged consecutive passage, but readily infect. This statement is only partially true, since the organisms on prolonged cultivation actually do suffer some loss of virulence or capacity to infect. A culture of *Tr. brucei* in the one hundredth generation will infect rats, but the period of incubation is somewhat lengthened; and

while death may occur within two or three weeks, it may not result until several months have elapsed from the time of inoculation, the longest survival being 191 days. Obviously, the conditions which obtain in cultivation, notably the composition and reaction of the medium, the temperature, and duration or age of culture, are not without appreciable effect on these organisms.

From the beginning, when the cultivation of *Tr. lewisi* and *Tr. brucei* was first effected, we have looked forward to the production of attenuated strains which could be utilized in preventive inoculations. It seemed reasonable to believe that the cultures of pathogenic protozoa, like those of bacteria, would be found available to some extent in the production of immunity. The fact that spontaneous recovery may occur in protozoal diseases, as is the case with relatively insusceptible species, indicates the establishment of an acquired immunity, and hence the inherent capacity possessed by such animal to protect itself against the given parasite. The trypanosomal infection of the common rat is a most excellent illustration of this fact, since it only exceptionally proves fatal. In the course of some weeks or months the rat gets rid of the trypanosome and becomes immune to a subsequent inoculation. It is evident, therefore, that the cultures of this parasite are particularly suitable for work bearing upon trypanosomal attenuation and immunity. With this organism it has been possible to demonstrate two important facts—first, that attenuation can be secured; and second, that such living attenuated cultures confer a solid and permanent immunity.

The culture of *Tr. lewisi* which we have used was isolated from a rat September 5, 1905, since which time it has been maintained on ordinary blood-agar medium, at 25°. It is at present in the three hundred and thirteenth generation. At first, the culture was readily infective, the growth from a single tube being sufficient to produce typical infection in the rat. This infective property persisted for a considerable period and was frequently utilized to supply infected rats for the laboratory. After a long interval, in March, 1909, this procedure to secure a rat infection was again resorted to; the culture then being in the one hundred and fifty-eighth generation. Contrary to expectation no infection resulted. During the next few weeks no less than 17 rats were tested by intraperitoneal injections, each receiving from two to four cultures. In every case, as before, the result was negative, although daily examinations were made for an entire month. These tests clearly demonstrated that this stock culture of *Tr. lewisi* had completely lost its capacity to develop within the rat. In other words, it had become fully attenuated.

The many inoculations made with this culture during the past three years have invariably failed to produce infection. The result

is the same whether the contents of a single tube or of 50 tubes is injected into the rat. Such cultures, grown at 25° for 7 to 10 days, were extremely rich in flagellates which at times formed a thick slimy covering on the blood-agar medium. Hence, the quantity of flagellates injected was at times enormous, and yet notwithstanding this fact no infection could be produced. The microscopic appearance of the cultures was in no wise different from that of the early generations which gave positive results, but the parasitic property of the organism was definitely lost.

All attempts to restore the infectious character to the culture have been fruitless. Even when the culture was placed in collodium sacs, in the peritoneal cavity of rats, it failed to multiply. Possibly further efforts in this direction may be successful.

While it is true, as has been emphasized above, that the cultures are no longer infective, it is an interesting fact that the majority of the inoculated rats do show in their blood, within the next day or two, a small number of fairly typical blood trypanosomes. These, however, do not increase in numbers and usually disappear within 48 hours after the injection. After that they are not to be found even though most careful examinations are made for a month or more. With the hope of restoring the virulence, the blood of rats showing these early trypanosomes was drawn from the heart and injected [3] into clean young rats, and was also planted at the same time on blood agar. Much to our surprise, it was found that such blood failed to infect the rats, and also failed to give cultures in the tubes.

The failure to secure a growth on the blood-agar medium was particularly surprising since, as is well known, this cultural method is capable of revealing trypanosomes even when prolonged microscopic examinations are negative. In all, about 12 rats which showed these transitory trypanosomes were cultured without obtaining the slightest indication of a growth. Similarly, the inoculation of nine rats with such blood, the doses varying from one-fourth to 3 cubic centimeters, failed to infect. Here, as above, the negative result could not be ascribed to the small number of trypanosomes, for it can be readily shown that the normal trypanosomal blood will infect when diluted to such an extent that the parasites can scarcely be detected under the microscope. Likewise, the susceptibility of our rats could not be called into question. In all of our work special care was taken to use only young rats, weighing from 60 to 90 grams, which had been repeatedly examined for two or more weeks and thus found to be free from natural infection. When used as controls, the injection of 1 cubic centimeter of a 1:10.000 dilution of blood containing *Tr. lewisi* invariably gave a rich infection.

It is evident, therefore, that the trypanosomes which appear transitorily in the blood of rats after the injection of a culture are incapable of further multiplication or reproduction. They are sterile or abortive forms, and without doubt their further study will prove of interest. It would seem as if some of the cultural trypanosomes still possessed a tendency to develop into the blood form, but the resulting individual through lack of inherent vigor or failure of fertilization(?) is unable to develop any further and soon disappears.

It is probable that these abortive forms are present in the blood of all rats inoculated with the cultures. They are, however, easily overlooked, and for that reason they have been found in only 75 per cent of the rats examined. They have been observed in the blood on one occasion five hours after the injection; at other times within 12 hours, but more often between 24 and 48 hours. Only exceptionally have they been seen as late as 72 hours and once they were observed to be present for four days. As already stated, the abortive forms are to be found in small numbers only. At times, after a prolonged search, but a single one can be found; more often, one can be found for every 5 or 10 fields (No. 7 objective); and, rarely, one for every two fields examined. The number of abortive forms is independent of the dose injected for in rats which received 50 cultures they were no more numerous than when a single culture is given. Likewise, the age of the culture seems to have no influence upon the number of these forms.

IMMUNITY.

As already stated, our previous studies have shown that cultures of *Tr. lewisi* when plasmolyzed [4] were capable of producing immunity in rats. It was therefore to be expected that the living attenuated cultures would behave in a similar way and confer protection against the blood trypanosome. The experimental work in this direction demonstrated that such was the case and that an active immunity was developed in animals which had received single or multiple injections of the living cultures.

In order to obtain absolutely conclusive results it was necessary to employ young rats, preferably those raised in the laboratory, which repeated examinations for at least two weeks before use had shown to be free from the natural infection. In the beginning, when rats which had been purchased on the market were used, it not infrequently happened that the control animals in an experiment would fail to become infected, thus invalidating the immunity test. This

difficulty was entirely overcome by employing only carefully tested young rats.

Another point of importance, not infrequently lost sight of in immunity tests, is the use of a very small but surely infective dose of the virulent organism, for the reason that a given degree of immunity may be effective against a minimal infecting dose but not against a hundred or thousand doses. A very large dose of virus may readily break down a slight immunity and thus lead to the erroneous conclusion that no protection exists. With this consideration in mind we have as a rule employed the test virus in a dilution (in 0.85 per cent salt solution) of 1:10,000. One cubic centimeter of this suspension has never failed to produce a rich infection in clean young rats. In some instances, as shown in the tables, suspensions of 1:200 or 1:2,000 were used.

On examination of Table I several interesting facts will be noted. When the interval between the injection of the vaccine and the test dose is but two or three days (rats Nos. 3, 9, 20, 21, 27) a rich infection results, showing that little or no immunity exists at that time. Possibly a smaller dose of the test virus might have shown some immunity at this early date, because this is certainly in evidence on the fourth day (Nos. 5 and 23). On the other hand, but one of the two rats inoculated on the eighth day (No. 28, which received six cultures) developed sufficient resistance to abort the infection.

TABLE I.—*Immunity tests made after a single injection of two cultures and six cultures.*

TWO CULTURES.

Rat No.	Interval between injections.	Test dose of *Tr. lewisi* blood.	Result.	Remarks.
		c. c.		
1	14	0.005	⊕	1 trypanosomes on third day.
2	14	.005	○	
3	2	.0005	+	Rich infection.
4	18	.0005	○	
5	4	.0001	○	
6	9	.0001	○	
7	13	.0001	○	
8	16	.0001	⊕	Very mild infection, 1 per field for 7 days.
9	3	.0001	+	Rich infection.
10	8	.0001	+	Do.
11	12	.0001	○	
12	16	.0001	○	
13	10	.0001	○	
14	10	.0001	⊕	Very mild infection, 1 per field for 9 days.
15	10	.0001	○	
16	10	.0001	○	
17	10	.0001	○	

TABLE I.—*Immunity tests made after a single injection of two cultures and six cultures*—Continued.

SIX CULTURES.

Rat No.	Interval between injections.	Test dose of *Tr. lewisi* blood.	Result.	Remarks.
		c. c.		
18	14	0.005	○	
19	14	.005	○	
20	2	.005	+	Rich infection.
21	2	.0005	+	Do.
22	18	.0005	○	
23	4	.0001	⊕	Very mild infection, one-tenth per field for 3 days.
24	9	.0001	○	
25	13	.0001	○	
26	16	.0001	○	
27	3	.0001	+	Rich infection.
28	8	.0001	⊕	Very mild infection, 1 per field for 6 days.
29	17	.0001	○	
30	17	.0001	○	
31	17	.0001	○	
32	17	.0001	○	
33	17	.0001	⊕	Very mild infection, one-fifth per field for 4 days.

In the tests tabulated above controls were inoculated every time after the experimental animals and developed a rich and lasting infection.

○ Indicates no infection, i. e., immunity is present.

+ Indicates a rich infection, the same as that in the controls.

⊕ Indicates a mild or abortive infection characterized by the presence of very few trypanosomes per field in fresh blood preparation.

Very mild or abortive infections may occur, as will be seen, in rats inoculated even on the tenth (No. 14), fourteenth (No. 1), and seventeenth (No. 33) day, but in these the parasites were as a rule very scanty and persisted for but a few days. These infections correspond to those which can be produced by injecting a large dose of trypanosomal blood into rats which have recovered from a natural infection. The breaking down of the immunity in such cases is usually indicated by a mild infection of but a few days' duration.

Altogether it will be evident that immunity is produced by the injection of living cultures of *Tr. lewisi*, and that this immunity is most pronounced after the lapse of about 10 days. In the experiments discussed the smallest dose of vaccine was represented by the growth present in two culture tubes.[5] The minimum dose of the living culture, sufficient to immunize, is probably a very small fraction of that mentioned. Thus, in one experiment four rats were inoculated with the growth corresponding to one-fourth, one-half, one, and two culture tubes, respectively. After an interval of 12 days these rats and 2 controls were inoculated with 0.0001 cubic centimeters of trypanosomal blood; the treated rats showed no infection, whereas the controls became heavily infected.

Subcutaneous injection of cultures.—As might be expected, a notable difference in immunity production is obtained according as the vaccine is introduced intraperitoneally or subcutaneously. When introduced by the latter route a much larger dose of the culture must be given in order to obtain protection. Only one experiment with single injections, given subcutaneously, was made and is worthy of

note. As shown in Table II, the rats which received two cultures became infected as heavily as did the controls, whereas those which received at the same time six cultures showed a mild abortive infection which persisted for one and three days, respectively. Evidently a single injection given subcutaneously is much less effective than when given intraperitoneally, for while a fraction of a culture is sufficient when administered by the latter route a much larger dose is necessary when injected under the skin.

When several injections are given subcutaneously the resulting immunity is much more marked, since the absorption of the antigen is necessarily greater. One experiment of this kind is given in Table II and shows perfect protection.

TABLE II.—*Immunity tests after subcutaneous injection of living cultures.*

Rat No.	Received.	Interval before test dose.	Test dose of *Tr. lewisi* blood.	Result.	Remarks.
			c. c.		
1	2 cultures	18 days	0.0001	+	Rich infection.
2	do	do	.0001	+	Do.
3	6 cultures	do	.0001	⊕	Mild infection on 3 days.
4	do	do	.0001	⊕	Mild infection on 1 day. Two controls gave a rich infection.
5	5 injections in 5 days, each of 2 cultures.	17 days	.0001	○	Perfect immunity.
6	do	do	.0001	○	Do.
7	do	do	.0001	○	Do. Four controls gave a rich infection.

MULTIPLE INJECTIONS.

In Table II, Nos. 5, 6, and 7 show that multiple injections of the culture given subcutaneously impart a marked degree of immunity. A number of similar tests were made, the injections being intraperitoneal, in order to obtain hyperimmunity and to test the resistance of such rats to relatively large doses of trypanosomal blood. The rats thus immunized, while fully protected against a minimal dose of virus, on the injection of a fairly large dose, such as 0.25 cubic centimeter, may show a mild abortive infection which disappears in from two to three days. An exactly similar "breakdown" of immunity frequently occurs when a large dose of infective blood is injected into rats which have spontaneously recovered from an infection with *Tr. lewisi*. These abortive infections depend largely upon the dose and to some extent upon the rat itself.

The results of these tests are given in Table III. By way of explanation it should be stated that Nos. 1 to 4 received in the course of 12 days three injections each of 6 cultures; Nos. 5 and 7 in 58 days received three injections each of 2 cultures, while Nos. 8 to 10 in the same time were given also three doses each of 4 cultures, and Nos. 11 to 13 received similar injections each of 6 cultures. Nos. 14 to 21

were given in the course of 67 days 6 injections, the first four receiving each time 2 and the last four 6 cultures.

TABLE III.—*Immunity after multiple injections.*

Rat No.	Received.	Interval before test dose.	Test dose of *Tr. lewisi* blood.	Result.	Remarks.
			c. c.		
1	3 injections of 6 cultures each in 12 days.	13 days..	0.25	⊕	Trypanosome present on 2 days.
2	do	do	.25	⊕	Trypanosome present on 3 days.
3	do	do	.25	○	Full protection.
4	do	do	.25	⊕	Trypanosome present on 2 days. Four controls gave rich infection.
5	3 injections of 2 cultures each in 58 days.	5 days...	.1	⊕	
6	do	do	.1	○	
7	do	do	.1	⊕	Trypanosome present on 4 days.
8	3 injections of 4 cultures each in 58 days.	do	.1	○	Two controls for this set gave rich infection.
9	do	do	.1	○	
10	do	do	.1	○	
11	3 injections of 6 cultures each in 58 days.	do	.1	○	
12	do	do	.1	○	
13	do	do	.1	○	
14	6 injections of 2 cultures each in 67 days.	7 days...	.005	○	This set of 8 were injected two weeks later with 0.25 cubic centimeters of virulent blood. All resisted perfectly this second injection. Four controls for this set gave rich infection.
15	do	do	.005	○	
16	do	do	.005	○	
17	do	do	.005	○	
18	6 injections of 6 cultures each in 67 days.	do	.005	○	
19	do	do	.005	○	
20	do	do	.005	○	
21	do	do	.005	○	

DURATION OF IMMUNITY.

Since a single injection of the living culture protects against a surely infective dose of *Tr. lewisi*, it was of interest to ascertain the duration of such immunity. This active immunity becomes manifest in about 10 days, and once developed it probably persists until the death of the animal. Up to the present time we have not tested out the immunity for a longer period than five months, but there can be little doubt that it will be found to last for a considerably longer period.

In Table IV, which may be looked upon as a continuation of Table I, are brought together the several tests in which the interval between the injections exceeds 18 days. The several groups were tested at different times with the usual dose of 0.0001 cubic centimeters of trypanosomal blood. In every case controls were inoculated at the same time and invariably gave a rich infection.

TABLE IV.—*Duration of immunity following the single injection of living cultures.*

Rat No.	Cultures received.	Interval (in days) before test dose.	Test dose of *Tr. lewisi* blood.	Result.	Remarks.
			c. c.		
1	2	35	0.0001	○	
2	2	35	.0001	○	
3	6	42	.0001	○	
4	6	42	.0001	○	
5	6	74	.0001	○	
6	6	74	.0001	○	
7	2	78	.0001	○	
8	2	78	.0001	⊕	A single trypanosome was found on each of 2 days.
	2	84	.0001	○	
10	2	84	.0001	○	
11	2	112	.0001	○	
12	6	119	.0001	○	
13	2	150	.0001	○	
14	6	159	.0001	○	

IMMUNIZATION AGAINST NATURAL INFECTION.

The marked protection following the introduction of living cultures suggested the possibility that vaccinated rats would be equally protected against natural infection by the flea or louse. The number of parasites present in the test dose of blood employed in the previous experiments must be considerably larger than can be introduced through the agency of a biting insect. If, therefore, no other factor is involved it should be possible to protect the rats against the natural infection by means of insects.

The white rat, which we have used exclusively, has never been found in this laboratory to harbor fleas, and consequently we have been unable to undertake experiments with this insect. The rats, however, are often heavily infected with lice, and since, unquestionably, these as well as fleas are agents of transmission, we endeavored to protect the rats against this source of infection.

In our first experiment we tried to secure infection by the direct transfer of lice from infected rats to a set consisting of four clean and four vaccinated rats, each of the latter having previously been given an injection of six cultures. Although considerably over a hundred lice were transferred to each rat no infection followed. Later on, therefore, these rats were confined in a small space with infected rats which were heavily infested with lice, but the result was no better. At the end of five months, although blood examinations were made twice weekly for over four months, no trypanosomes could be detected in the exposed rats. The failure of the controls to become infected was not due to an unrecognized infection, since one of these, inoculated on the one hundred and thirty-third day with 0.0001 cubic centimeter of virulent blood, gave a typical infection.

For the second experiment 10 rats were injected, each with six cultures. Five of these (see Table I, Nos. 29–33) were tested 17 days later and found to be immune. The remaining five, together with five clean rats for control and five rats containing *Tr. lewisi* and heavily infested with lice, were placed in a small cage, where they remained for several months. The rats were examined at least once a week for two months, but no spread of the infection occurred.

A third experiment was more successful. As above, a group of 10 rats were first injected, each with two cultures, and after 10 days 5 of these were tested and found to be immune. (See Table I, Nos. 13–17.) The remainder, together with 5 clean and 8 lousy, infected rats, were confined in a small cage. Later on, 5 additional infected and lousy rats were added. Of the vaccinated rats 4 died on the twenty-fourth, twenty-ninth, fifty-second, and one hundred and thirtieth day, respectively, without at any time showing trypanosomes in their blood. Of the 5 clean controls, 2 died on the sixty-first and one hundred and sixth day without becoming infected. The remaining 3 did become infected on the twenty-eighth, sixty-ninth, and eighty-first day. The fact that 3 out of 5 nonimmunes and none of the vaccinated animals became infected would indicate that the living vaccine does protect against infection by the louse. Further tests, however, especially with directly transferred lice, will be necessary to fully establish this point. It seems from the work done thus far that the lice from young rats which have been inoculated with *Tr. lewisi* but a few days are more likely to convey the infection than those from rats having an old chronic infection.

CURATIVE ACTION OF CULTURES.

The readiness with which the living culture immunizes against infection opens the possibility of using such material to abort, or, in other words, cure an infection already under way. The extremely rapid and heavy infection in the case of *Tr. lewisi* makes this at the outset a very unpromising attempt; for when a relatively small dose of trypanosomal blood, as shown in Table III, may serve to break down an existing immunity it is very probable that the enormous number of parasites in the infected animal will exert a corresponding action, and hence completely overwhelm any resistance which might be produced by the vaccine. Possibly repeated inoculation of large quantities of vaccine might eventually give rise to an amount of antibodies sufficient to check the parasites present.

Before, however, undertaking to put an end to a well-developed infection it was desirable to ascertain whether it was possible to check an infection at the very beginning; in other words, to prevent it by the simultaneous injection of virus and vaccine. In one experiment of this kind, three young rats received an intraperitoneal

injection of 0.0001 cubic centimeter of trypanosomal blood. Two of those were reserved for controls, while the third was given, likewise intraperitoneally, within an hour, a suspension of the growth from 50 cultures. A fourth rat also received 50 cultures, and served as control. It showed a few abortive trypanosomes on the first two days, but otherwise no sign of infection. Trypanosomes did not appear in the controls until the third day, and then in very small numbers, about 1 in every 10 fields of the fresh blood. In the treated rat, on the contrary, they appeared on the first day, were 2 per field on the second, and 4 per field on the third day. Some blood drawn from the tail of this rat on the second day and injected into another produced a typical infection, thus demonstrating that the trypanonomes present were not of the abortive type. The appearance of the trypanosomes in the treated rat so much earlier than in the untreated controls is an interesting fact which was corroborated in the second experiment.

Although the trypanosomes in the untreated controls appeared later than in the treated rat, yet once on, they multiplied more rapidly, and in three days were several times more numerous than in the latter. On the seventh day they approximated, roughly speaking, about 200 per field, and this rich infection was maintained during the following three weeks. In the treated rat the maximum number was about 100 per field on the eighth to the eleventh day; the parasites then decreased and disappeared on the thirtieth day, at which time both controls still showed a maximum infection. This experiment indicated that the injection of a sufficiently large dose of vaccine, shortly after the infective dose, modifies somewhat the course of the infection. The result, however, was not as sharp and conclusive as might be desired.

Consequently, a second experiment was made. Two rats were given as before an infective dose of 0.0001 cubic centimeter. One of these was given 100 cultures, in three injections, during the next three hours. In this treated rat, as in the one mentioned above, trypanosomes were found on the first and second days, at which time none could be found in the control. Stained preparations made at this time showed that the trypanosomes were nearly all of the large "female" type, many of which were undergoing active division as indicated by the presence of double nuclei, blepharoplasts and even of flagella. Minute flagellates, such as are formed by the breaking up of the eight-celled rosette, were also noted. Of especial interest is the fact that though the trypanosomes appeared earlier than in the control they did not continue to increase as they did in the latter.

In the treated rat the trypanosomes at first appeared to be stimulated to very rapid multiplication, but this was soon checked, and then actually the number was greatly decreased, so that on the sixth

and seventh days on an average not more than one could be found in every two fields of a fresh-blood preparation. After this there was a gradual rise, and although the rat was examined for 26 days the number never exceeded above 75 per field. The course of the infection in this treated rat, even more so than in the first experiment, is indicative of a marked inhibitory influence, and points to the possibility of aborting an infection by repeated large doses of the vaccine.

The course of the infection in the rats of this last experiment can best be seen from the following summary. The figures there given express roughly the number of trypanosomes present, per field, of the No. 7 objective, of a fresh-blood preparation. Thus, 1/10 is to read as 1 trypanosome in 10 fields; 3, as that many per field, etc.

[Inoculated Feb. 26.]

	Examined.											
	February.			March.								
	27	28	29	1	2	3	4	5	6	7	8	9
Treated rat	1/10	3	10	10	5	½	½	5	10	10	25	50
Control rat	.....	.....	1/20	15	75	100	150	200	200	200	250	Dead.

PASSIVE IMMUNITY.

Since the animals treated to one or more injections of living cultures develop a very marked immunity, it was to be expected that their blood would carry antibodies, and consequently no special effort has as yet been made to otherwise demonstrate their presence. Three tests, however, of a preliminary character, were made with the blood of rats which had received several spaced injections. These tests, like the curative experiments given above, were intended to ascertain the effect of simultaneous injections of virus and hyperimmune blood. The results, it will be seen, are by no means satisfactory.

Experiment No. 1.—The immunized rat received seven injections, each of four cultures. After an interval of 153 days, 1 cubic centimeter of blood was drawn from its heart and injected into a clean young rat. This was followed at once by an injection of 0.0001 cubic centimeter of trypanosomal blood. A like dose of the virus was given at the same time to two controls and to the hyperimmune rat. The controls developed the typical rich infection, whereas the latter, as expected, resisted perfectly, although five months had passed since the last protective inoculation had been given. The rat which received the dose of immune blood became infected the same as the controls. Apparently the blood was without protective action.

Experiment No. 2.—The immunized rat received four injections, each of six cultures. Seventeen days after the last inoculation it was bled and two rats were injected with its blood, receiving 2 and 0.5 cubic centimeters, respectively. Within a minute these two rats and two controls were each given 0.0001 cubic centimeter of trypanosomal blood. The rat which received 2 cubic centimeters of the immune blood had a period of incubation of five days; the other three rats showed parasites on the third day. Otherwise there was no difference, the severity of the infection in the treated rats being the same as in the controls. Here again the blood seemed to be without any protective action.

Experiment No. 3.—The immune rat in this test had been given a total of 34 cultures in six injections. It was bled after an interval of 31 days and two rats were given of its blood 3 and 1 cubic centimeters, respectively. This injection was followed within four minutes by the usual dose of trypanosomal blood (0.0001 cubic centimeter). The same dose of virus was given to two controls and to two young rats born of a mother which had received an injection of two cultures. The latter and the controls gave like rich infections. The treated rats, while they possibly showed fewer trypanosomes on the first two days of the infection, eventually gave as rich infections as the controls.

It is evident that in these three tests passive immunity was not conferred. Had the immune blood been injected one or two days previous to the infective dose, the result might have been different. To protect against the virus, when given simultaneously, a much larger dose of blood is needed, or else the blood must come from animals which are more highly immunized.

EFFECT OF BERKEFELD FILTRATES OF PLASMOLYZED CULTURES.

Since living as well as dead plasmolyzed cultures immunize against infection with *Tr. lewisi*, it may be pertinent to inquire whether this immunity is due entirely to the solid intracellular constituents or whether soluble products are in any way concerned. In order to obtain some light on this point, a large number of cultures (120) were prepared. The growth was taken up in 0.85 per cent salt solution and transferred to collodium sacs, immersed in running distilled water, and subjected to plasmolysis for 18 hours. At the end of that time the flagellates had disintegrated or rather shrunk to small rounded forms. The contents of the sacs were then centrifugated, at 8,000 revolutions, to remove the cell detritus and the clear liquid was passed through a small Berkefeld filter. The filtration, aided by an aspirator, was rapid and required but a few minutes.

The clear filtrate was injected into 12 rats, each pair receiving the equivalent of 2, 4, 6, 12, 12, and 24 cultures, respectively. Twelve

days later each of these, as well as four controls, received 0.0001 cubic centimeter of trypanosomal blood. One of the treated rats which received the equivalent of 4 cultures gave a mild infection which cleared up on the ninth day. All of the other treated rats developed as rich infections as did the controls, and consequently the single exception referred to is of no significance. The only conclusion which can, therefore, be drawn from this test is that the Berkefeld filtrates of plasmolyzed cultures have no immunizing properties. It may be added parenthetically that the same fact has been noted by Dr. Cumming in connection with his studies (unpublished) on rabic virus. While plasmolyzed suspensions of this virus confer a marked immunity, the filtrates of such suspensions are inert. In other words, it would seem that the insoluble constituents of the cultures, as well as of the rabic virus, are essential to the production of the immunity.

SUMMARY.

Tr. lewisi, after cultivation for several years on rabbit blood-agar medium, becomes non-infective.

Trypanosomes may appear in very small numbers in the blood of rats inoculated with such cultures, but they are incapable of multiplication in vitro or in vivo.

Rats which have received one or more injections of the living culture acquire a solid immunity, which becomes apparent in about 10 days.

The immunity produced by the living culture is lasting and probably persists through life.

The immunity induced by the living vaccine is probably efficacious against the natural transmission through the flea and louse.

The immunity is not due to soluble products, since plasmolyzed and filtered cultures are inert.

This successful immunization against *Tr. lewisi* by means of a living vaccine renders it probable that like results may be obtained with the more strictly pathogenic trypanosomes. It may be added that encouraging results have already been obtained with *Tr. brucei*.

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[1] This research has been aided by a grant from the Rockefeller Institute.

[2] Novy.—Immunity against Trypanosomes. Proc. Soc. Exp. Biol. and Med., 1907, vol. 4, p. 42.

[3] All injections unless otherwise indicated were given intraperitoneally.

[4] This method of preparing a vaccine, while not generally applicable, has since then been utilized in this laboratory by Dr. J. G. Cumming, in charge of the University Pasteur Institute, in the preparation of a safe antirabic vaccine. His experiments have shown that the dialyzed virus protects animals even more efficiently than does the desiccated virus prepared in the ordinary way.

[5] The tubes used for cultures were small, being but 12 by 150 millimeters. After inoculation the tubes were placed in a hot room at 25° for from 7 to 12 days. The growth was then taken up in 0.85 per cent salt solution and at once injected.

SUR LA PROPHYLAXIE DES TRYPANOSOMIASES.

F. Mesnil, Professeur à l'Institut Pasteur, et E. Roubaud, Chef de Laboratoire.

Plusieurs rapporteurs devant traiter spécialement la question de la prophylaxie de la maladie du sommeil, nous serons brefs sur cette trypanosomiase et nous envisagerons sa prophylaxie surtout comme un cas particulier de la prophylaxie des trypanosomiases à glossines.

Maladie du sommeil—Suppression du réservoir de virus.—Un côté du problème de la lutte contre la trypanosomiase humaine doit être néanmoins envisagé à part, c'est celui qui consiste à empêcher l'homme infecté de servir de réservoir où les insectes vont puiser le virus.

A cet égard, une première mesure consiste à isoler autant que possible les malades du sommeil. Il existe des régions, encore indemnes, où néanmoins toutes les conditions, favorables à l'éclosion de la maladie, paraissent réunies (ex.: certaines régions de l'Afrique occidentale où les *Glossina palpalis* abondent). Des mesures doivent être prises pour que des individus atteints de trypanosomiase ne puissent pas infecter ces régions. Des ententes, par exemple comme celle existant entre les gouvernements de l'Afrique occidentale française et de l'Afrique équatoriale française, seront des plus utiles. Dans les régions déjà contaminées, les hommes malades devront être recherchés avec soin et isolés dans des villages, dits de ségrégation, disposés dans des conditions telles que les malades s'y trouvent bien et demandent à y rester. Ces villages seront naturellement des lieux de traitement, et on n'oubliera pas qu'une bonne nourriture est un adjuvant très important dans l'action des médicaments.

Mais, à notre avis, la mesure prophylactique la plus efficace consiste dans la stérilisation, pour un temps plus ou moins long, du sang circulant des trypanosomés. Les Drs. Aubert et Heckenroth, de l'Institut Pasteur de Brazzaville (Congo français), qui ont pratiqué sur une large échelle cette prophylaxie chimique, et qui pensent qu'elle "permettra d'obtenir rapidement de décisifs avantages," sont arrivés aux conclusions suivantes:

Parmi les médicaments susceptibles de jouer un rôle important dans la prophylaxie chimique de la trypanosomiase humaine, il faut citer l'atoxyl et l'arsénophénylglycine. Ce dernier, utilisé à doses convenables de 4 cgr. 5 à 5 cgr. par kilogramme, en une, ou mieux deux injections intra veineuses à six jours d'intervalle, permet d'obtenir des durées de stérilisation supérieures à 12 mois dans la majorité des cas. Des malades, suivis régulièrement pendant plus d'une année, de 15 à 25 mois, n'ont pas présenté de rechute et sont dans un excellent état de santé. Chez certains sujets, à la première période de la maladie, ce traitement prophylactique ainsi compris semble devoir conduire à la guérison définitive.

La technique des injections intraveineuses ne doit pas être considérée comme un obstacle à l'utilisation de ce médicament dans les campagnes de prophylaxie.

L'atoxyl ne possède pas un pouvoir de stérilisation d'une aussi longue durée que l'arsénophénylglycine, toutes choses égales d'ailleurs. Pour obtenir une durée de stérilisation suffisante et donner une efficacité pratique à l'intervention thérapeutique, il faut arriver à trois ou quatre injections successives, ce qui entraîne, dans les campagnes de prophylaxie, quelques difficultés matérielles avec lesquelles il faut compter, mais qui ne sont pas insurmontables.

Les résultats obtenus dans la vallée de la Haute-Sangha prouvent qu'avec l'atoxyl seul on peut restreindre considérablement la morbidité par trypanosomiase.

Dans les régions à maladie du sommeil, il est indispensable que des tournées médicales périodiques soient effectuées par un personnel uniquement chargé de ce service. Ces missions auront pour but: 1°, de repérer les endroits contaminés; 2°, d'apprécier exactement le nombre des individus atteints, par l'examen systématique de tous les indigènes; 3°, de faire le traitement prophylactique de tous les malades comme il est indiqué ci-dessus. Le traitement curatif ne sera fait que dans les postes où un médecin se trouve en permanence.

Aubert et Heckenroth ajoutent que les indigènes du Congo reconnaissent déjà les bons effets de ces mesures et viennent en masse se faire traiter.

À côté de l'homme, le gros gibier joue un certain rôle dans la conservation du virus; exemple, les rives désertées du Lac Victoria restées infectantes. Toute mesure dirigée contre le gros gibier sera donc utile. Mais, sauf peut-être pour ce qui concerne la trypanosomiase humaine de Rhodesia et du Nyassaland, il ne faut pas se faire trop d'illusions sur l'efficacité de la destruction du gibier.

L'instruction des indigènes devra se faire peu à peu, mais on ne peut compter sur des résultats immédiats.

L'administration devra étudier le remplacement des industries prédisposantes (pêche; confection du charbon de bois; cultures au bord des eaux) dans les zones contaminées, par d'autres qui mettront les indigènes plus à l'abri de l'infection possible. L'extension de la vente du poisson sec, des sécheries sahariennes, pourrait aider en Afrique occidentale à éloigner des rivières des populations ne vivant que de pêche.

D'une façon générale, l'administration devra exercer son action sur les villages dans un sens utile à la prophylaxie. L'étude des moyens propres à diminuer les chances de contagion dans les différentes régions devra être fait soigneusement par elle, d'après les conseils techniques de personnes informées, spécialement affectées à ce service.

Lutte contre les glossines.—En dehors de la maladie du sommeil, un certain nombre de trypanosomiases animales de l'Afrique intertropicale sont conservées à l'état endémique ou enzootique par les glossines ou tsétsés. Au point de vue des conditions de vie, une distinction doit être faite entre les glossines, nettement hygrophiles, qui ne se rencontrent jamais loin des rives ombragées des cours d'eau (la *Gl. palpalis* est le type de ces tsétsés) et les glossines xérophiles, telles que la *Gl. morsitans*—qui vit dans la brousse et même la savane et s'éloigne

des rivières à la poursuite de sa proie. Des espèces, comme *Gl. longipalpis*—présentent des conditions de vie intermédiaires.

Les moyens à employer pour supprimer les glossines, ou mettre l'homme et les animaux à l'abri de leurs piqûres, diffèrent donc suivant l'espèce qu'il s'agit d'atteindre.

Contre la *Glossina palpalis*, l'agent principal de propagation de la maladie du sommeil et de plusieurs trypanosomiases animales, comme la souma, il faut déboiser, ou au moins éclaircir les galeries forestières dans les endroits fréquentés par les hommes (points d'eau, gués, ponts, etc.), ainsi qu'aux points de passage des caravanes et des troupeaux. Il faut abattre les arbres le plus complètement possible, couper les palmiers nains touffus qui, malgré leur faible hauteur, forment un couvert impénétrable où s'abritent les glossines; détruire les lianes; en un mot, faire de la forêt une clairière.

Pour la protection des villages, il faut comprendre un déboisement absolu sur une étendue variable autour des villages ou des lieux fréquentés, avec déboisement partiel (éclaircissement) sur une zone périphérique, la plus étendue possible; l'incendie des herbes ou de la brousse n'est pas utile. Si une protection efficace ne peut être réalisée, le déplacement des villages dans de zônes sans tsétsés, est indiqué.

Contre la *Glossina longipalpis* qui propage, entre autres, la baléri, il faut abattre les broussailles vertes et les petits arbres touffus qui bordent les derrières des cordons forestiers des cours d'eau.

Contre la *Glossina morsitans*, qui parait apte à propager la plupart des trypanosomiases des zones où elle habite, et, en Rhodésia, la trypanosomiase humaine, il faut élaguer la forêt claire, abattre les buissons épineux (jujubiers, mimosées) où la mouche gîte souvent. L'incendie de la brousse, à la saison favorable, peut être utile.

Les mesures d'action contre cette glossine, dont les gîtes sont mal définis, sont surtout difficiles. Sa présence dans la brousse claire ou la forêt plus ou moins couverte est surtout fonction de celle du gibier. Elle le suit et peut se trouver abondante un jour, là où on ne la rencontre plus peu après. La destruction du gibier est, dans ce cas, une mesure fondamentale. Il n'y aura d'élevage intensif possible dans les zones à tsétsés qu'avec la disparition du gibier. La question des réserves de chasse et de la protection du gros gibier, actuellement à l'étude, est absolument contraire au but prophylactique qu'il y a lieu d'atteindre, et par suite à l'intérêt économique des colonies.

Cette destruction du gibier doit être préconisée partout où il y a des trypanosomiases animales transmises par les tsétsés, quelle que soit l'espèce de glossine en cause.

Dans les vastes territoires de l'Afrique tropicale, les régions d'élevage se trouvent surtout à l'intérieur, loin des côtes. Le moyen le plus économique d'amener les animaux (en particulier les bovidés)

dans les colonies côtières ou dans les ports d'embarquement, est de les faire voyager en troupeaux. Pour que ces troupeaux ne se contaminent pas en route, comme c'est généralement le cas à l'heure actuelle, des routes sanitaires doivent être créées. Le tracé de ces routes doit être étudié avec soin par des personnes compétentes; les points de traversée des cours d'eau doivent donner lieu à une attention spéciale et, s'il y a lieu, être débarrassés des glossines en employant les procédés décrits précédemment.

À côté de ces mesures générales, des mesures individuelles peuvent être prises. L'homme protégera autant que possible, par des gants ou des voiles, les parties découvertes de son corps. Des pièges à tsétsés seront mis en œuvre. On cherchera à écarter ces insectes par des fumées. On évitera, si possible, de voyager le jour. Mais toutes ces mesures ne seront jamais que de faibles palliatifs. Ce n'est qu'en recourant aux mesures générales sur lesquelles nous avons insisté qu'on arrivera peu à peu, à force de persévérance, à faire disparaître les trypanosomiases à tsétsés.

Lutte contre les autres insectes convoyeurs.—Un grand nombre de trypanosomiases ne sont pas transmises par les tsétsés. Pour certaines d'entre elles (surra, trypanosomiases dites sahariennes), il parait bien établi que ce sont des insectes tels que les stomoxydes, les tabanides, qui transmettent l'infection. Les mêmes insectes joueraient aussi un rôle dans la propagation des trypanosomiases à tsétsés. Bouffard a clairement prouvé que, dans le cas de la souma, si la maladie est conservée enzootiquement par les glossines, elle se propage épizootiquement dans les troupeaux par d'autres insectes tels que les stomoxes. Dès 1907, les membres de la Mission française de la maladie du sommeil ont attiré l'attention sur l'existence au Congo d'épidémies de familles et de cases; divers insectes, en particulier des moustiques domestiques (*Stegomyia* et *Mansonia*) ont été incriminés, sans preuve décisive jusqu'ici, dans cette propagation épidémique.

Dans ces cas il est d'abord indiqué d'isoler l'homme (voir *supra*) ou les animaux malades. Pour ces derniers, surtout lorsqu'on se trouve dans une contrée jusque-là indemne, il y a lieu de les abattre pour éviter toute propagation de la maladie. Si le pays est depuis longtemps contaminé et si l'on se trouve en présence de cas guérissables, soit spontanément (bovidés et, en général, ruminants), soit par la thérapeutique, on peut se contenter d'isoler les animaux malades; des écuries obscures et à ouvertures convenablement grillagées sont indiquées. L'animal, soustrait au travail et bien nourri, sera dans les meilleures conditions pour guérir.

Des règlements de police sanitaire devront déterminer les conditions de cet isolement et surtout le moment où on peut le faire cesser.

On n'introduira pas, autant que possible, d'animaux de zones saines.

Dans la lutte contre les Stomoxes, il convient de distinguer les stomoxes urbains (*sp. calcitrans*) et les stomoxes de brousse (*sp. nigra*, le propagateur du surra à l'île Maurice). Le grillagement des écuries est désirable pour empêcher les adultes de pénétrer. Pour éviter la ponte et la reproduction du *St. calcitrans*, nettoyer avec soin le sol des écuries qui devra être parfaitement cimenté; éviter les crevasses et les fentes. Déposer les fumiers au grand soleil, dans un lieu sec; si possible les enfouir ou les brûler. Surveiller, aux alentours des fosses à purin, la terre imbibée d'urine, à l'ombre; la crésyler, s'il y a lieu, ou la pétroler.

Il est impossible de songer à détruire les stomoxes de brousse (*St. nigra*, etc.) ou de prévenir leur ponte dans les pâturages. On évitera, pour les bestiaux, les zones humides, marécageuses, les bords des fleuves où les stomoxes sont surtout abondants. Les mêmes mesures protégeront les troupeaux contre les tabanides (*Tabanus*, *Chrysops*, *Hæmatopota*). Les troupeaux devront camper autant que possible sur des lieux élevés et découverts; on devra les abreuver à des endroits connus et surveillés.

Dans l'établissement des routes sanitaires, dont nous avons parlé à propos de la lutte contre les glossines, on devra tenir compte du danger des autres insectes piqueurs.

On a parlé à diverses reprises d'un rôle possible des hippobosgues; ce rôle est resté hypothétique, sauf pour le *Tr. theileri* qui n'est pas à proprement parler pathogene. La seule manière de lutter contre eux serait, dans les écuries, de surveiller les bêtes et de les baigner fréquemment. Les mouches quittent le corps des hôtes au contact de l'eau.

Sélection de races résistantes.—Tous les essais faits jusqu'ici pour vacciner contre les trypanosomiases n'ont pas encore abouti à des conclusions pratiques. Mais on sait depuis longtemps que des animaux infectés guérissent spontanément. Ils acquièrent généralement de ce fait une immunité solide et de longue durée, au moins vis-à-vis de l'inoculation expérimentale; cette immunité sera à vérifier vis-à-vis de la contagion naturelle (piqûres d'insectes).

Il est donc indiqué de rechercher les races animales les plus réfractaires aux trypanosomiases et de sélectionner ces races. Déjà une pareille sélection a dû se faire dans la nature, car il a été constaté depuis longtemps que les races indigènes sont plus résistantes aux trypanosomiases que les races importées (c'est une raison de plus pour importer le moins possible de races non acclimatées).

Dans cet ordre d'idées, c'est surtout du côté des ruminants (bovidés, chèvres et moutons) qu'on peut espérer résoudre le problème. Certaines races ont déjà été remarquées pour leur résistance particulière (races naines). Il y aura lieu de les propager, surtout dans les zones à *Gl. morsitans*, au voisinage immédiat du gibier réservoir de

virus. Nous avons vu en effet que c'est dans ces cas que la lutte est le plus difficile.

La question ne se pose malheureusement guère pour les équidés. Il y aura lieu, autant que faire se peut, de les remplacer par des bovidés pour les transports.

Lutte contre la dourine.—La dourine mérite une place à part, car c'est probablement la seule trypanosomiase qui n'est pas propagée par les insectes et pour laquelle il n'y a pas d'autre réservoir de virus que l'équidé reproducteur.

Des mesures de police sanitaire existent dans les divers pays permettant de lutter efficacement contre cette maladie. Elles consistent essentiellement dans la recherche des animaux contaminés (et l'on sait que la découverte de la nature trypanosomique de la dourine a apporté un sérieux appui à cette recherche), dans l'abatage des juments et l'abatage ou la castration des étalons. Cette prophylaxie, relativement facile dans les pays où les chevaux sont dûment catalogués, l'est moins quand des équidés échappent au contrôle; c'est le cas des baudets "rouleurs" algériens, non déclarés, qui font la saillie clandestine. Ces baudets infectent les juments qui, à leur tour, contaminent les étalons de la remonte. Aux États-Unis, la présence de la dourine chez les chevaux demi-sauvages des Indiens a été indiquée en 1901 par Salmon comme un obstacle à la prophylaxie.

Si la dourine devient, comme il y a lieu de l'espérer d'après les faits enregistrés à ce jour, une maladie curable, la police sanitaire pourra être modifiée. Le vétérinaire militaire français Monod propose: (1) Que le traitement des animaux atteints soit autorisé à condition de les laisser soumis jusqu'à guérison à la surveillance du service sanitaire; (2) que les étalons traités et guéris puissent être conservés comme géniteurs. Monod estime qu'un étalon peut être utilisé pour la monte s'il n'a montré aucun symptôme de dourine pendant les six mois qui suivent la cessation du traitement, et si des injections sous-cutanées de 40 cc. de sang faites à des lapins dans les trois mois qui précèderont la monte, à raison d'une injection par mois, restent sans résultat.

L'adoption immédiate de ces mesures serait premsaturée.

Défense des régions indemnes.—On n'a encore signalé aucun cas de maladie du sommeil contracté en dehors de l'Afrique tropicale. La défense doit donc surtout viser les régions de cette partie de l'Afrique, où les insectes transmetteurs existent et où néanmoins la maladie manque. Nous avons déjà parlé de cette défense au début de notre exposé. Elle peut se résumer en ceci: Tout individu provenant d'une région infectée ne pourra pénétrer dans une région saine que muni d'un certificat sanitaire. On pourra admettre des

trypanosomés traités et paraissant en bonne voie de guérison à condition qu'ils restent sous la surveillance de l'administration qui les

L'adoption immédiate de ces mesures serait prématurée.

Pour les trypanosomiases animales à tsétsés, il y a peu à craindre qu'elles ne débordent les territoires occupés par ces insectes. Pourtant, le cas de la souma, qui s'est implantée en Erythrée et dans la Province de Kassala, permet de concevoir certaines inquiétudes à cet égard.

Le danger est surtout grand pour les trypanosomiases transmises par des insectes, tels que les stomoxes et les taons, qui sont répandus, même dans les régions tempérées. Des mesures sévères viseront l'importation d'animaux provenant des régions infectées (dont la liste devra être dressée). Pour les maladies du type surra, on devra surtout veiller à l'introduction de bovidés ou de camélidés infectés; chez ces animaux la maladie est souvent latente, presque toujours de longue durée et peut être facilement méconnue. Pour la dourine c'est naturellement les équidés seuls qui sont à surveiller.

Il serait exagéré de prohiber complètement cette importation. Mais il sera nécessaire de faire subir une quarantaine aux animaux importés. La recherche du trypanosome sera faite par tous les moyens dont on dispose actuellement: Examen microscopique du sang, répété au besoin pendant plusieurs jours; examen des sérosités (surtout dans le cas de la dourine); inoculation de fortes doses de sang à des animaux sensibles, etc. Tout animal, ainsi reconnu trypanosomé, devra être abattu. Ce n'est qu'à ce prix qu'on préservera sûrement les pays indemnes. L'exemple récent des États-Unis, où Mohler et Thomson du Bureau of Animal Industry ont réussi à empêcher l'introduction du surra, amené par des Zébus de l'Inde, devra servir de guide en pareille occurrence.

Si on laisse une trypanosomiase animale prendre pied dans une région jusque-là indemne, la lutte deviendra bien plus onéreuse et plus difficile, surtout s'il s'agit d'une région continentale.

TRYPANOSOMA RHODESIENSE (Stephens and Fantham), A SECOND SPECIES OF AFRICAN TRYPANOSOME PRODUCING SLEEPING SICKNESS IN MAN.

J. W. W. Stephens, M. D., Cantab., and H. B. Fantham, D. Sc. Lond., B. A., Cantab.

PREFATORY NOTE.

Early in 1910 a case of sleeping sickness in a European from Northern Rhodesia was being treated in the Royal Southern Hospital, Liverpool. The case was studied from various points of view by Sir Ronald Ross and Dr. D. Thomson.

In March of the same year I was demonstrating the trypanosomes in the blood of a rat sent as *T. gambiense* to a class of students, when I noticed certain peculiarities in the structure of the trypanosomes. These peculiarities were so striking that I remember well telling my students to label their slides "*T. gambiense* (?)," as I felt certain that some mistake had been made. On inquiry I found that the rat had been inoculated with the blood of the patient in hospital, though at the time I was ignorant of this. I now proceeded to see if the forms I had observed were to be found in the ordinary laboratory strain of *T. gambiense*, but after examining the latter over and over again I was unable to find them. In a letter dated May 9, 1910, to the advisory committee for the tropical diseases research fund I noted these points. In the meantime I was continuing my observations on this trypanosome, and eventually I mentioned my suspicions that I was dealing with a trypanosome that was not *T. gambiense* to my colleague, Dr. Fantham, who kindly consented to help me in describing it and before doing so to make quite certain again that *T. gambiense* did not show these forms. [J. W. W. S.]

We finally felt that our position was secure and we read a paper on the subject before the Royal Society on November 3, 1910, the concluding paragraph of which is as follows: "Our own view is that we are dealing with a new species of human trypanosome for which we propose the name *Trypanosoma rhodesiense*."

We mention these points somewhat in detail because they appear not to be generally known, but all the dates can be verified by reference to the literature.

Before describing, in a summary way, the evidence in favor of the specificity of *T. rhodesiense*, we would emphasize the fact that the identification of a trypanosome is a very difficult matter, and that, with our increase in knowledge, the difficulty has hardly decreased—in fact, it may be stated to have increased. We must, in fact, make use of every possible means at our disposal, even though these may not be perfect. What, then, is the evidence on which we base our belief that *T. rhodesiense* is a second species of African trypanosome, producing sleeping sickness in man?

(1) THE MORPHOLOGY.

The peculiarity of this trypanosome is that in the blood of all subinoculated animals the nucleus, instead of being in the middle or near the middle of the trypanosome, as is usually the case, is in some of the short or stumpy forms of the trypanosome near the posterior end, more or less close to the blepharoplast (kinetic nucleus) or even on its posterior side. We believed, and still believe, that this morphological feature alone definitely enables us to distinguish the trypanosome from *T. gambiense*.

(2) ANIMAL REACTIONS.

Laveran sums up the question of the animal reactions as follows:

The total results correspond with those of other authors (viz, Bevan, Yorke, Fantham, Laveran, Mesnil, and Ringenbach and others), and show that *T. rhodesiense* is clearly distinguished from *T. gambiense* by its great virulence for the majority of animal species; whereas in rats and mice *T. gambiense* has very variable virulence, some animals being refractory, others contracting light infections, *T. rhodesiense* invariably kills them. In the guinea pig, dog, and *Macacus* monkeys the duration of *T. rhodesiense* infections is shorter than that of *T. gambiense* infections. In sheep and goats the difference in the evolution, symptomatology, and gravity of the two infections is quite remarkable; whereas *T. gambiense* infections in these animals often give rise to no symptoms except fever (often missed if one does not take the temperature) and usually ends in recovery, *T. rhodesiense* infections lead to an acute disease with high fever, edema, and keratitis, and death is invariably the end after a relatively short duration.

(3) SERUM REACTIONS.

(*a*) *Action of immune serum* (Mesnil and Ringenbach).—(1) A goat was infected with *T. rhodesiense*. Twenty-two days later its serum+*T. rhodesiense* injected into a mouse. Result: Protection.

(2) The serum+*T. gambiense* injected into a mouse. Result: Infection.

(*b*) *Action of baboon serum.*—Contrary to *T. gambiense*, *T. rhodesiense* is very susceptible to human and baboon serum. Thus Mesnil and Ringenbach performed the following experiment:

A dose of 1 cubic centimeter of baboon (*Papio anabis*) serum cured mice with *T. rhodesiense*. In the same dose it acted very feebly on *T. gambiense*.

(*c*) Action of human serum.—One cubic centimeter of human serum cured *T. rhodesiense* mice in 3 out of 4 cases; on *T. gambiense* mice there was no appreciable effect.

Laveran and Nattan Larrier have shown the same, viz, that human sera act on *T. rhodesiense*, but are quite without action on *T. gambiense*.

(*d*) *Trypanolytic reactions.*—The results got by Mesnil and Ringenbach are most demonstrative in the case of trypanolytic reactions. The sera of animals (man, monkey, guinea-pig) infected with *T. gambiense* are trypanolytic for the homologous trypanosome, i. e., *T. gambiense*, but have no action on the heterologous trypanosome, i. e., *T. rhodesiense*.

(4) CROSS IMMUNITY EXPERIMENTS.

(1) Mesnil and Ringenbach immunized a monkey (*Macacus rhesus*) against *T. gambiense*. It was inoculated with *T. rhodesiense* on June 7, 1911; on June 27 trypanosomes appeared (the infection was slight); on July 4 it died. A control died in 10½ days.

(2) Laveran immunized a goat and mouse against *T. gambiense;* when they had acquired a solid immunity they were inoculated with *T. rhodesiense*. They became infected like the controls.

(3) Laveran and Nattan-Larrier immunized a goat against *T. brucei;* it subsequently became infected with *T. rhodesiense*.

(4) Laveran immunized a ram and a sheep against different strains of *T. brucei*. Inoculated with *T. rhodesiense* they both acquired acute infection and died. Conclusion: *T. rhodesiense* is not *T. brucei*.

When the converse set of experiments is tried, namely, immunizing an animal against *T. rhodesiense*, and then inoculating with *T. gambiense*, the difficulty immediately arises that it is impossible to immunize an animal against *T. rhodesiense*, owing to its virulence. But a partial and transitory immunity to *T. rhodesiense* can be got by treating the infected animal with drugs, such as arsenophenylglycin. The results, as far as they go, seem to show that an animal immunized against *T. rhodesiense* is immune not only to *T. rhodesiense*, but also to *T. gambiense*, a fact which, according to Mesnil and Leger, does not invalidate the specificity, but tends to show that the two trypanosomes are closely related.

(5) MODE OF TRANSMISSION.

Although not regarding it as an absolute specific characteristic, it is interesting to note that, according to Kinghorn and Yorke (1912):

(1) *T. rhodesiense* is transmitted by *Glossina morsitans*, both in laboratory experiments and in nature.

(2) That about 16 per cent of the wild game examined in Northern Rhodesia is infected with *T. rhodesiense*.

(6) CURVE OF MEASUREMENTS.

We have measured 2,000 *T. rhodesiense*, and the curve differs from that obtained by Surg. Gen. Bruce for 1,000 *T. gambiense*.

CONCLUSION.

When we first announced this trypanosome it seemed to be very generally assumed that it was a variety of *T. gambiense*, and that its peculiarities were due to the fact that it was probably transmitted

by *Glossina morsitans*. We have never held this view, as we considered that there were no facts to warrant such an assumption. We believe that sleeping sickness in Rhodesia, Nyasaland, and adjoining territories is due to a specific trypanosome, *T. rhodesiense;* that the disease is not due to *T. gambiense*, recently introduced, but, on the contrary, though this may be difficult to prove, that it has existed in these territories from time immemorial.

MURRINA, A TRYPANOSOMAL DISEASE OF HORSES IN PANAMA, AND THE MEANS USED IN CONTROLLING AN OUTBREAK.

Dr. S. T. Darling, Chief of Laboratory, Isthmian Canal Commission, Ancon, Canal Zone.

I wish to call your attention to this disease chiefly for the reason that it affords what I think is an unusual example of practical sanitation, in that an outbreak of trypanosomiasis among mules and horses was checked by the use of simple measures and has been kept out of the corrals for over two years.

Epidemiology.—The term "murrina" is used to characterize a fatal type of equine trypanosomiasis encountered on the Isthmus of Panama.

Shortly before October, 1909, a fatal disease appeared among the mules and work horses at the Gatun corral, called "stomach staggers" and "swamp fever" by the veterinarians. The disease was confined to a lot of mules and horses that had arrived from the United States via New Orleans in April, 1909. After arrival, and before distribution, the animals were turned out with some native horses in a pasture at Gatun. This pasture has been used for native cattle and horses for many years. After five weeks some of the mules were distributed to other stations and the remainder retained at Gatun.

In June a horse and several mules from this lot died at the Gatun corral. The physical signs noted by the veterinarians were briefly these: A falling away in flesh, the coat becoming rough and staring. A voracious appetite would generally be maintained. There was an irregular elevated temperature, reaching 104° or 106°, rarely 108°. General weakness developed, with a staggering gait, and the animal leaning against the stall. Edema of the sheath, abdominal walls, and legs was observed in some cases. There was usually well-marked anemia, with pallor or a dirty yellow color of the visible mucosæ.

The course of the disease resembled "swamp fever" or the "infectious anemia of equines" so closely that it was diagnosed and treated as such by the veterinarians.

On February 23, while examining a stained specimen of the blood of work horse No. 121, from the Ancon corral, when his temperature was 102°, I found several trypanosomes. Upon inquiry it was ascertained that this animal, No. 121, had formerly been worked at Gatun, and presumably had been exposed to infection there. After the discovery of the trypanosome in horse No. 121 I found them in the blood of 17 mules and horses, all of which died or were sacrificed.

The notion that the disease was "swamp fever" has had to give way to one that it is a fatal form of trypanosomiasis.

It became important to ascertain whether the disease had been introduced from the United States or was endemic in this region. Nothing like it had been observed in the corrals here since 1904. Specimens of the trypanosome were referred to Dr. Laveran, who very kindly expressed an opinion that the microorganism was not *Tr. equinum* of Mal de Caderas, nor *Tr. equiperdum*, the pathogenic agent of dourine.

The possibility of the infection of American horses or mules by African or Asiatic animals from circuses or zoological gardens presented itself, but that was negatived by Dr. Mohler, of the Bureau of Animal Industry, United States Department of Agriculture, in his reply to my query:

"The only importations of equines from Africa have been zebras for zoological gardens or circuses, and since 1906 all such animals, as well as camels, antelope, deer, and other species capable of transmitting the various forms of trypanosomiasis have been subjected to the blood test by the inoculation of experimental rabbits. Thus far we have never found any infection of these animals, nor have they been known to infect horses or mules with which they have subsequently come in contact."

"The appearance of surra in the United States was in 1906, when 51 Indian cattle were imported for use in southern Texas. * * * All infected animals were killed and burned and a rigid quarantine maintained. * * * These animals were then shipped to Texas, and although the ranches in that vicinity have been visited a number of times since, there has been no further indication of surra."

The possibility of there being a local endemic trypanosomal disease among native horses and other animals was now inquired into. So far as could be ascertained, there had been no evidences of this disease among the coach horses of the cities of Panama or Colon.

During the end of the rainy season, 1909, some time after its occurrence, and too late for its investigation by animal inoculations, there were reported six deaths among native horses at a place up the Chagres River, near Bohio. The animals are reported as having leaned against the fences and died.

An interesting piece of information was elicited from the owner of the pasture in which the American mules had been placed after

their arrival. This gentleman had four native ponies which had been let out at Colon. Upon their return to the pasture, three of them developed "staggers" and died. This occurred about the time of the outbreak among the American mules.

Sr. A, who has had for years considerable experience with cattle and horses in Panama, examined three of the sick mules at Ancon, and expressed his opinion that they were suffering from murrina.

Mr. Q and Mr. X, who have had some experience with horses and cattle in this region, the West Indies, and Colombia, were of the opinion that the disease was derrengadera, which they had seen among horses and mules along the Sinu River, in Colombia, and also in the colder regions of Antioquia, Colombia. In the cases seen by them in Colombia the rump and flanks of the animals grew thinner, and they appeared to dry up in their hind quarters. Finally, there was paralysis of the hind legs, appearing a few days before death. Whole ranches were devastated. In the interior of Colombia the disease was called "peste ranguera;" on the coast, "renga." In the Republic of Panama the natives speak of two endemic diseases among horses, known locally by the names murrina and derrengadera. Murrina is usually a disease having a chronic course, with weakness and swelling of the belly wall. Derrengadera is a disease that may be slow or rapid in its course, but in which there is always weakness, particularly of the hind legs.

During a sanitary survey of the native towns of Chame and La Chorrera, some 25 miles from the city of Panama, and of Guarare, La Ville de los Santos, and Chitre, in the Province of Los Santos, Republic of Panama, I ascertained that both murrina and derrengadera were known locally; and during the past 18 months I have seen two cases of the disease in native ponies in the Republic, not far from the city of Panama. Animal inoculations from these cases were positive for *Tr. hippicum*.

It was desired to ascertain if a disease similar to "swamp fever" had been observed in the West Indies, for the reason that there is some importation of horses from Jamaica to the Canal Zone. Through the courtesy of the commissioner of agriculture for the West Indies, Hon. Francis Watts, C. M. G., it was ascertained that the disease was not known in British Guiana or Antigua, but had been seen in the practice of one veterinary surgeon in Barbados. The resemblance of "swamp fever" to equine trypanosomiasis suggests the possibility that the latter disease might exist in some of the larger islands, where it could have been introduced from Colombia, or this region.

From this testimony it is seen that there is in this region a trypanosomal disease of equines, of which there are two types. In one, weak-

ness, wasting, and edema predominates; this is called "murrina." In the other, posterior paresis is the predominant sign. This is known locally as derrengadera. The disease is always fatal.

THE PATHOGENIC AGENT.

The pathogenic agent is *Trypanosoma hippicum* Darling.[1, 2]

There is some variation in its morphology. The typical trypanosome is 16 to 18 mikrons in length, 2 mikrons wide, the distance from kinetonucleus to the posterior tip about 1.75 mikrons, and the distance from the posterior tip to the middle of the trophonucleus is from 7.5 to 10 mikrons. The flagellum is usually short and frequently not entirely free, for often the attenuated process of the cytoplasm extends to the extreme end of the chromatin filament; but at times there is a free flagellum, reaching 4 mikrons in length. The trophonucleus is placed a little posterior to the middle, the relation being 1:2.8 to 1:2.4. The kinetonucleus is usually placed about 1.75 mikrons from the posterior tip; but sometimes it is quite at the tip, and occasionally may be 3 mikrons from it. The posterior tip is often rather blunt and usually obtuse, never being as attenuated as the posterior tip of *T. lewisi*. The cytoplasm usually contains numerous basophilic granules scattered throughout the cytoplasm or arranged in lines in the anterior and posterior halves. The granules are coarse and from 0.5 to 1 mikron or more in diameter. There may be 16 to 18 in number, most of them being placed, usually, in the anterior half. The lateral margin of the trypanosome may stain more deeply than the interior. Some of the longer forms contain few or no granules. A well-developed undulating membrane is present and the chromatin filament extends from the kinetonucleus to the anterior tip of the flagellum. When rapidly proliferating in the rat or mouse, some forms approach 28 mikrons in length and become 3 to 4 mikrons in width. From this description it is quite evident that the trypanosome is different from *T. equinum* of mal de caderas and *T. equiperdum* of dourine.

There is some variability in the presence and in the staining qualities of the basophilic granulations. Some specimens from the horse would have few or no granulations, while others had several deeply staining ones. One film from *M. alexandrinus* had many trypanosomes and none contained granules, though the cytoplasm stained deeply; from the same rat there were other specimens containing many well-stained granulations. It has appeared at times as though when the trypanosomes were multiplying very rapidly they were longer, more attenuated, and freer from granules.

PATHOLOGICAL ANATOMY OF MURRINA.

When a mule or horse is sacrificed before the disease has run its course there may be very few gross lesions and none characteristic of the disease other than emaciation, edema of dependent belly wall, sheath, or legs, conjunctival ecchymoses, or some splenic enlargement. If the animal is permitted to die naturally there are lesions which are characteristic and usually well marked.

The spleen is slightly enlarged, but its capsule, particularly the external surface, is dotted over with petechiæ limited to the capsule, usually 1 to 2 millimeters in diameter. The recent ones are bright red, while those somewhat older are reddish brown in color. The pulp is slightly increased in amount and the reticulum appears normal.

The kidneys contain petechiæ, 1 millimeter in diameter, distributed chiefly in the cortex, just beneath the capsule.

The endocardium and epicardium usually contain large and small hemorrhages. Favorite sites are the papillary muscle, mitral leaflets, and the epicardial fat along the coronary arteries, oftenest near the base of the heart.

The pleuræ and peritoneum in some cases have been the seat of numerous petechiæ.

The renal lymph nodes are usually enlarged, and one or two of the set are frequently the seat of extensive hemorrhages.

There are usually hemorrhages into the conjunctival or nasal mucosæ at some time during the disease.

Sometimes there is an excess of clear, serous fluid in the peritoneal, pleural, or pericardial cavities, but this is not constant, nor is the edema of the sheath, legs, hocks, or lower belly wall constant.

Other viscera show no changes.

Filaria and intestinal nematodes and cestodes were encountered inconstantly.

The microscopic changes are fairly characteristic and constant. In the kidneys the focal hemorrhages and the acute glomerulitis, occasionally with necroses, make a rather striking picture. The spleen always shows the same appearance—phagocytosis of red blood cells and the presence of blood pigment in small and large clumps of refractile granules. In the liver the one unvarying feature is the presence of bronze-colored blood pigment in the endothelial cells of the sinusoids. There is a localized leukocytosis here and focal necroses. Renal lymph nodes usually show great engorgement, hemorrhage, and phagocytosis of red blood cells by large mononuclear phagocytes. The hemorrhages in other viscera present nothing of special interest.

Table of the period of incubation, or latency, and the duration of the disease in susceptible animals.

Animal.	Period of incubation.	Duration of disease.
Horse	Horse No. 10 (?) (work horse)	54 days.
	Saddle horse No. 47, 8 days	79 days dying—sacrificed.
	Work horse No. 121, (?) days	73 days—possibly 219+ days.
Mule	Mule No. 136, 6 days	98 days (treated with arsenic).
	Mule No. 239, (?) days	130 days (treated with arsenic).
	Mule, No. 318, avirulent strain, 11 days.	Treated with arsenic—recovered.
	Mule No. 520, (?) days	42 days.
	Mule No. 263, (?) days	10 days.
	Mule No. 257, (?) days	18 days.
	Mule No. 185, (?) days	55 days.
	Mule No. 204, (?) days	25 days.
Dog	Dog No. 121–2, less than 9 days; puppy, 6 days.	38 days.
	Dog, avirulent strain	Recovered.
Cat	Cat No. 121–2, less than 8 days	Do.
Kitten	Kitten No. 121–2, less than 8 days	14 days.
Cebus	Cebus No. 121–1, less than 12 days	43 days.
Nictipithecus felinus.	Nocturnal species (probably Nictipithecus sp., 5 days.	32 days.
Rabbit	Rabbit 121–1–A, less than 12 days	163 days.
	Rabbit 121–1–B, less than 12 days	106 days.
Guinea pig	7 days	Animals have lived 27, 50, 75, 99, 119, 189, 190, and 336 days.
Agouti	Agouti No. 121–2, less than 10 days	Recovered.
Coati	Coati No. 382–2, 6 days	24 days.
Opossum	Opossum No. 382–a, (?) days	34 days.
Raccoon	Raccoon No. 10–2, less than 14 days	52 days.
White rat	4 to 5 days	19 days.
Wild rat	Wild rat (M. rattus), 4 to 5 days	9 days; 2 recovered.
	Wild rat (M. norvegicus), 4 to 5 days	40 days.
	Wild rat (M. alexandrinus), 4 to 5 days.	11 days; 1 refractory.
White mouse	White mouse, 3 days	8, 11+ days.
Wild mouse	Wild mouse (M. musculus), 5 days	8, 9, 12, 15+ days.
Pig	Pig No. 382–2, trypanosomes appeared once 15 days after inoculation—never sick.	
Calf	Calf No. 121–2, refractory. After three months the blood was not infectious for guinea pigs.	
Birds	Birds: Pigeon, refractory	

Differentiation from other forms of trypanosomiasis.—It is necessary to establish the fact that murrina is a specific disease, distinct from other forms of equine trypanosomiasis.

From the total number of trypanosomes known to science invading mammals, those of rodents, cattle, bats, etc., may at once be dismissed from consideration, as they are not pathogenic for equines, viz, *T. lewisi*, *T. Theileri*, etc.

The following trypanosomes may also be dismissed from consideration, for the reason that they are either pathogenic for cattle or present well-marked morphological and other points of difference from *T. hippicum; T. evansi*, *T. brucei*, *T. dimorphon*, *T. pecaudi*, and *T. cazalboui.*

T. equiperdum, the pathogenic agent of dourine (mal de coit), is differentiated by morphology, it containing no basophilic granulations, by the fact that it is extremely rare in the peripheral blood of equines and further by clinical features, mode of transmission, dourine being a disease transmitted during copulation; and further by the insusceptibility of monkeys and guinea pigs to *E. equiperdum.*

There remains one trypanosome which must be carefully differentiated from *T. hippicum.* That one is *T. equinum*, the pathogenic

agent of mal de caderas. Dr. Laveran's opinion has been given elsewhere.[3] In addition to this valuable testimony we will consider what other characters may be discovered in the two diseases which may be used to differentiate them.

Mal de caderas is an epizootic trypanosomal disease of equines in South America. The trypanosome was discovered by Dr. Elmassian,[4] director of the Bacteriological Institute at Asuncion, Paraguay, in 1901. Geographically, the disease is distributed in regions along the tributaries of the Rio de la Plata in Argentina, Uruguay, Paraguay, Brazil, and Bolivia, and also in the Federal district of Matto Grosso, between the Madeira and Zingu Rivers, tributaries of the Amazon in Brazil, and on the island of Marajo at the mouth of the Amazon.

Certain clinical and pathological features are mentioned as being more or less characteristic of mal de caderas. It should be mentioned, however, that there is much similarity among all equine trypanosomal diseases; that they, varying from one another, usually present certain characters recognizable as belonging to the type, symptom and pathological group, such as anemia, emaciation, edema, effusions, posterior paresis, hemorrhagic nephritis, and remittent pyrexia. Furthermore, if we take one disorder and observe all its vagaries, we shall see that each individual case does not necessarily conform to the specific disease type.

In mal de caderas the characteristic symptom would seem to be, as its name implies, posterior paresis; yet, as Voges points out, in a series of cases unusual forms present themselves—"a number of animals may remain quietly standing up to the last moment and then fall in a heap and die at once."

The fairly constant features in which murrina differs from mal de caderas seem to be these:

Duration of disease in mules and horses.—Murrina is far more common among mules than horses. This has been undoubtedly due to the nature of the mules' work here, rendering them more liable to infection through cuts and galls. The duration of the disease is the same in mules and horses. The longest duration recorded is in a horse. According to Voges the duration of mal de caderas in horses is one to two months, while in mules it is one year, if they receive good care and treatment. This is quite different from my observations of murrina.

The number of trypanosomes in the blood of mules and horses.—The blood of several mules suffering from murrina has been examined daily over periods of several weeks or months and trypanosomes were easily found at intervals, particularly before and during a febrile paroxysm. Voges states, however, that in mal de caderas trypanosomes can not be demonstrated microscopically in the blood of mules

suffering from the disease for days and weeks. In one case, he states, after two months' daily diligent examination, trypanosomes were found only once during an attack, and in numbers much less than in the horse. In another case, trypanosomes were only found on two days during the duration of the disease in a mule. In murrina no difficulty has ever been experienced in detecting trypanosomes in mules if the examinations were made during a febrile paroxysm; and trypanosomes are also frequently found when the temperature is normal. Furthermore, the blood of infected horses has never been found to contain more trypanosomes than that of infected mules.

Character of fever.—A very exact idea of the type of fever in mal de caderas could not be obtained, for the reason that most of the published charts are based on single daily temperature records. There appears, however, to be no very marked differences in the types of fever between murrina and mal de caderas.

Elmassian has described plaques of dermatitis on the neck, shoulders, and rump of horses in mal de caderas, but these have never been observed in cases of murrina.

Keratitis and hypopyon are mentioned as being seen in horses infected with *T. equinum*, but neither of these conditions has been observed in horses or mules suffering from murrina.

Diarrhea, said to be a common symptom in mal de caderas, according to Elmassian, has not been observed in murrina, save in one horse that had received 21 grams of arsenic.

Hemoglobinuria and hematuria have never been observed in cases of murrina. If they were at all common it would have been noticed, for all the animals have been kept under observation by the veterinarian in the corrals. These symptoms are said to be constant in mal de caderas.

DISTINGUISHING PATHOLOGICAL FEATURES OF MURRINA.—These are very important means of differentiating the two diseases. They are as follows: Splenic capsular ecchymoses; renal petechiæ; epicardial and endocardial hemorrhages and ecchymoses, and less frequently pleural and peritoneal petechiæ. These, with the hemorrhages into the renal lymph nodes, make up a picture quite different from mal de caderas, and one more like nagana and "equine anemia."

The spleen is not greatly enlarged in murrina but always appears to be so in mal de caderas.

Fibrinous exudation into the pleural and pericardial cavities, described as constant in mal de caderas, is very rarely seen in murrina. (There was a fibrinous clot in the right pleural cavity of mule 263.)

MODE OF TRANSMISSION AMONG THE CORRAL ANIMALS.—When my attention was called to the disease it had already destroyed about a dozen animals in two of the largest corrals, and after discovering its

trypanosomal nature I began at once to ascertain its natural mode of transmission. Curiously enough, the disease was confined to mules and work horses. About 30 in all died of the disease. Saddle horses never became infected naturally, though they proved as susceptible as mules when inoculated experimentally. After this had been ascertained, it was possible to rule out ticks as carriers of the disease, for mules were seldom or never infested by ticks, while the saddle horses, from the different character of their work, were frequently infested by ticks during the dry season while the disease was prevalent.

Biting flies were next investigated; it was always possible to collect stomoxys in the corrals, though they did not breed there, for droppings were removed daily. A number of stomoxys were dissected to learn whether they harbored insect flagellates, but none was ever detected in their intestinal tracts. On one occasion specimens of stomoxys were taken from an infected mule, but on dissection no traces of trypanosomes nor of other flagellates could be detected; and a number of specimens were taken from the corral with the blood of mules or horses in their intestinal tracts, but trypanosomes and flagellates were absent.

A few tabanidae were taken at the new corral at Ancon, near some woods. Murrina, however, had not made its appearance at this corral. Horse flies were never seen at the old corral, nor at the corral in Gatun, both of which are located away from the woods. Tabanidae are never encountered here until one gets out into the woods along the country roads or on the trails. It was not possible to incriminate horseflies as carriers, nor the stable fly, for although the latter was visiting the corral at Ancon and biting mules and saddle horses indiscriminately, none of the saddle horses ever became infected, although during a period of six months mules, a few feet away, in the same corral, kept coming down with the disease.

This would seem clearly to rule out any biting insect as a carrier, for, assuming a biting fly to be a carrier, the chances for infection would be equal among saddle horses and work animals; as a matter of fact the saddle horses were exposed to a much wider and more dangerous environment than the work animals, for the latter were used within the village or city limits, or in the lock site, while saddle horses in addition to being in these places were used out on the trails, visiting native villages where murrina had existed.

The one fact which stood out prominently in my study of this phase of the disease was that the work animals became infected while the saddle horses escaped. Most of the infected animals had been worked on scrapers at Gatun—very exhausting work—and although their nutrition and physical condition were usually excel-

lent. they were constantly being sent to the sick corral with cuts and injuries. Observing that the infected mules leaned against the sides of their stalls a few days before death, it was seen that excoriated patches appeared at the points of contact with the stall. Infected serum exuded from these places, which was constantly visited by flies.

The evidence all tended now to confirm me in the opinion that the unspeakable flies acted as carriers of the virus by alternately taking up the trypanosomes in the exuded serum of infected animals and depositing them on the fresh cuts of noninfected animals. It was realized that farriers, too, might have carried the infection in a few instances while dressing the wounds of the animals.

It was not possible to test this theory experimentally at this time, but subsequently I succeeded in infecting a mule through the excoriated skin by means of *Musca domestica* in the following way:

Three lots of *Musca domestica* were caught and each was placed in a biting jar. A guinea pig richly infected with *Trypanosoma hippicum* was bled from the ear. Two or three drops of blood were placed on the center of a glass plate, which was inverted over the biting area of the jar containing the flies. Jar A contained about 18 flies, jar B, 9, and jar C, 6. A number of the flies in each jar were seen to feed on the guinea pig's blood, those in jar A being hungrier than the others.

The glass plate with the guinea-pig blood was carefully replaced by a towel that was used to wipe away any possible droplet of blood that might have touched the rim of the jar or that might have been deposited near the rim by one of the flies. This was done to prevent any possible inoculation of the mule by guinea-pig blood that might be on the margin of the jar. The towel was replaced by a clean glass plate that was slipped out when the biting area of the jar was placed over the recently shaved, scratched skin of the mule. In each experiment the flies were exposed to the guinea-pig blood for three or four minutes, and then, after an interval of about 30 seconds, were placed over the scratched skin of the mules, where they remained for about five minutes. As the flies were not hungry, they fed with some difficulty, and as the experiment was conducted out of doors in bright sunlight, they sought the opposite end of the jar and could be made to visit the scratched skin only by covering the jar and making it quite dark. On this account the conditions of the experiment were probably not as favorable for infecting as they would have been under natural conditions in a corral, yet after a period of 10 days, the usual incubation period in mules for the strain of *Trypanosoma hippicum* employed, the temperature of one of the animals rose to 103° F., and its blood contained *Trypanosoma hippicum*. The other two mules have shown no signs of infection.

The mule that became infected had been exposed to the flies in jar A, which contained about 18 active vigorous specimens that had been caught about two hours before the experiment.

Murrina is not now epidemic in the Canal Zone; in fact, no cases have been detected since May, 1910, so that the possibility of the mule's having become infected in any way other than by that of the experiment is too remote to be considered. Besides, a particularly avirulent strain was used in the experiment, the period of incubation of which (10 days) is two to three days longer than that of other strains. The incubation period in the infected mule corresponds with that of this avirulent strain.

For several days previous to their exposure to the flies the experimental mules had been under observation in a screened stable; their temperatures were taken twice daily, and their blood examined daily for the detection of trypanosomes.

The exact mechanism of infection was not known, i. e., whether the trypanosomes remained in the proboscis of the fly or on its legs, but it was believed that the trypanosomes remained alive within the proboscis, and I found later that this was undoubtedly the case, as the following experiment shows:

Several specimens of *Musca domestica* were caught in the market at Panama and fed with infected guinea pig's blood. Dissections were made to determine microscopically the duration of the viability of trypanosomes within the mouth parts, and living motile trypanosomes were detected two hours after the feeding. In order to test the viability of *Tr. hippicum* within the proboscis of the fly by animal inoculations, the beaks of several flies that had fed on the infected blood were snipped off into citrated saline solution, rubbed up in an agate mortar, and subinoculated into white mice. As would be expected, the blood of most of the animals displayed an intense bacteraemia, due to the many contaminating bacteria in the œsophagus of the flies; but one mouse that was inoculated from flies 23 minutes after the blood meal became infected and died of trypanosomiasis.

I have assumed from this that trypanosomes remain viable within the proboscis of *Musca domestica* sufficiently long to be a potent means of transferring the virus in the corrals in the way I have described.

Out in the bush and in the native villages there may exist some true suctorial intermediary host in addition to other sources and means of infection. While I have never seen in any of the infected animals placques of infiltration on the genitalia, the trypanosome was found to pass with ease through mucosa lined with stratified squamous epithelium, as in the vagina, mouth, or nose.

Using a syringe which could not abrade the vaginal mucosa, about 10 cubic centimeters of citrated saline solution containing about 0.5

of a cubic centimeter of guinea-pig blood richly infected with *Trypanosoma hippicum* were introduced into the vagina of a mule. Most of the fluid was ejected upon the ground, but did not come in contact with the skin or any abraded surface on the legs of the animal. On the tenth day the animal's temperature, which had been uniformly 101° F. morning and evening, rose to 102° F., but trypanosomes could not be detected, though there was some autoagglutination of erythrocytes. The appearance of this in other experimental mules I had observed just before trypanosomes could be demonstrated in films. On the morning of the eleventh day the temperature was 102.6° F., and trypanosomes were detected in films for the first time. The following morning the animal's temperature was 103.6° F.

In another mule the trypanosomes were introduced into the mouth and 5 cubic centimeters into the right nasal cavity, the muzzle of the mule being elevated so as to avoid waste of the infected fluid. The mucosa was not touched by the nozzle of the syringe. On the ninth days the animal's temperature rose from 101° to 102.8° F., and trypanosomes were detected in blood films.

These two experiments are of significance because they indicate positively that *Trypanosoma hippicum* can penetrate the mucosa of mules or horses. From this it is assumed that murina may be transmitted during copulation, or by swallowing an infected tick, flea, or other insect.

Being convinced that the disease was transmitted by flies in the way outlined above, the following recommendations for the treatment and care of animals were made and were very largely carried out:

Routine daily (b. d.) temperatures of all animals in the corrals to be taken for the detection of suspects.

All animals having a temperature above 101° F. are to be immediately isolated in a screened stable.

Diagnosis is to be made at the laboratory by blood examinations and inoculation of susceptible animals in those cases where it is believed trypanosomes have disappeared from the peripheral blood during the period between crises.

All infected animals are to be removed as far as possible from the corrals where they are to be sacrificed and buried.

The halters, instruments, and hands of attendants coming in contact with infected animals are to be disinfected.

All wounds, sores, galls, or cuts on all animals, whether infected or not, are to be protected from flies by protective dressings containing substances such as creolin, Kreso, or larvacide distasteful to flies.

Stray native animals are not to be impounded in or near commission corrals.

Sanitary inspectors and police are required to report all native and other animals suspected of having the disease.

The results have been entirely satisfactory, for the disease, which was advancing slowly but surely through two of the largest corrals, was arrested in its course, and in spite of the fact that the disease has been detected on several occasions among native animals in the Republic near by, no case has developed in the commission corrals since May, 1910.

[1] American Veterinary Review, XXXVIII, 375, June 1, 1910.
[2] Bull. Soc. Path Exot, 1910, 3, and 1911, 3.
[3] Laveran, Bull. Soc. Path. Exotique, March 8, 1911.
[4] Elmassian, Rev. Soc. Med. Argent. 1902, 10, p. 122.

ORIGINE ET RAPPORTS DU KALA AZAR ET DU BOUTON D'ORIENT.

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Depuis la découverte du parasite du Kala Azar par J. B. Leishman et de celui du bouton d'Orient par J. H. Wright, nos connaissances sur ce groupe de maladies, justement nommées les leishmanioses, ont fait de sensibles progrès. Il semble que le moment soit venu d'établir le bilan de ce que nous savons de ces infections; il sera facile d'en conclure quelles sont les lacunes et de déterminer dans quelles voies nous devons travailler pour arriver à les combler.

Aussi dans ce rapport, que votre bienveillance me permet de vous présenter, m'efforcerai-je de tracer le double et rapide tableau de nos acquisitions et de ce qui nous reste à découvrir, en m'en tenant exactement au titre que j'ai inscrit en tête de mon travail: Origine et rapports du Kala Azar et du bouton d'Orient.

Jusqu'à ce jour, on ne connaît que deux espèces d'êtres vivants naturellement atteintes de leishmaniose: l'homme, le chien.

Chez l'homme, les leishmania peuvent déterminer, suivant les cas, une infection généralisée: Kala Azar ou bien une lésion locale, bouton d'Orient. Chez le chien, la maladie naturelle est toujours généralisée, elle appartient donc au même type que le Kala Azar humain.

I. RAPPORTS DES LEISHMANIOSES ENTRE ELLES.

Avant d'exposer les rapports qu'offrent ensemble le Kala Azar et le bouton d'Orient, nous devons d'abord nous demander si le Kala Azar et le bouton d'Orient sont eux-mêmes des affections uniques ou s'il ne faut pas voir, dans ces appellations, des noms génériques, embrassant plusieurs maladies de types très voisins, mais de nature différente; en d'autres termes, existe-t-il un ou plusieurs Kala Azar, un ou plusieurs boutons d'Orient?

1. *Unité ou pluralité du Kala Azar.*—Je suis personnellement responsable d'avoir porté atteinte à l'unité du Kala Azar. Lorsque j'ai commencé à m'occuper de cette maladie, elle semblait à peu près

localisée aux Indes anglaises; les symptômes nous en étaient connus; le Kala Azar était décrit comme frappant indifféremment tous les âges; Leishman venait de découvrir son agent; Rogers d'en reconnaître la nature par une culture artificielle non repiquable; les localisations chez le malade en étaient également établies.

Les premiers cas qu'il me fut donné d'étudier en Tunisie, ceux que Pianese avaient antérieurement devinés à Naples, comme ceux qui furent découverts successivement dans tout le bassin méditerranéen, s'ils se montraient identiques comme symptômes aux cas indous, semblaient en différer par une donnée capitale, l'âge des malades; toutes nos observations pendant longtemps appartenaient uniquement à l'enfance, généralement aux premières années de la vie.

Bientôt, d'autres raisons vinrent s'ajouter à celle-ci et me portèrent à supposer que la maladie méditerranéenne pouvait n'être pas identique à l'indoue.

Tandis que, successivement et dans un délai très court (avec le virus de mon premier cas), j'obtenais sans difficulté la culture indéfiniment repiquable du parasite sur le milieu de Novy et MacNeal, la reproduction expérimentale de la maladie chez le chien et le singe, enfin que je découvrais, à côté de la maladie humaine et à son contact même, l'infection spontanée du chien, aucun de ces progrès n'était obtenu dans l'étude du Kala Azar des Indes. En raison de ces faits, et à titre essentiellement provisoire, je créai pour la maladie méditerranéenne le nom de Kala Azar infantile et pour son agent celui de *Leishmania infantum* (1909).

Les choses ont changé quelque peu depuis cette époque. Des cas de Kala Azar ont été rencontrés dans le bassin méditerranéen, exceptionnellement, il est vrai, chez l'adolescent et même l'adulte. Nous avons appris qu'aux Indes anglaises la maladie est plus fréquente chez l'enfant. Des cultures indéfiniment repiquables de la *Leishmania donovani* ont été réalisées par Row, soit sur le milieu originel de Novy, soit sur le milieu simplifié que je lui ai substitué. Mais, jusqu'à présent, malgré des essais sans doute trop peu nombreux, la maladie n'a pu être reproduite aux Indes chez le chien et, d'autre part, la leishmaniose canine naturelle, qu'il me paraît logique d'identifier avec le Kala Azar humain et qui a été trouvée en pays méditerrannéen, dans tous les points sans exception, où l'infection humaine sévit, paraît ne pas exister aux Indes, Ceylan (Castellani) excepté.

Tant que la reproduction expérimentale du Kala Azar n'aura pas été réalisée chez le chien avec le virus des Indes, la distinction que j'ai établie entre les deux Kala Azar infantile ou méditerranéen et indou devra être maintenue. J'attire l'attention de nos collègues anglais sur ce point; c'est à eux qu'incombe le soin de nous éclairer. Je souhaite que ce soit bientôt et par l'affirmative.

2. *Rapports du Kala Azar et du bouton d'Orient.*—Il n'existe peut-être pas deux infections aussi dissemblables par leurs symptômes que le bouton d'Orient et le Kala Azar; l'une, lésion locale cutanée, bénigne, saisonnière, à aire géographique limitée et spéciale; l'autre, maladie plus répandue, généralisée et grave.

La connaissance des agents pathogènes a seule pu rapprocher ces infections. Les deux leishmania sont identiques; la culture de celle du bouton d'Orient, que j'ai réalisée pour la première fois à Tozeur (sud tunisien), se fait sur les mêmes milieux que celle de la leishmania du Kala Azar; elles sont indéfiniment repiquables (j'en possède des cultures de 75° passage sur milieu NNN); la *Leishmania tropica* pousse assurément plus vite et plus abondamment, mais ce n'est là qu'un détail. Au point de vue expérimental, aucune analogie dans les résultats obtenus. Sans doute, dans mes expériences, j'ai rencontré les mêmes espèces sensibles et seulement celles-ci: singe, chien; mais chez eux, que le produit inoculé soit le virus ou la culture, si l'injection en est faite sous ou dans la peau, on obtient une lésion typique avec le bouton d'Orient, rien ou bien un œdème sans caractères et diffus avec le Kala Azar; l'inoculation intrapéritonéale des virus ou des cultures donne des résultats aussi dissemblables; rien, pas même une immunité consécutive avec le bouton d'Orient (jusqu'à 100 cultures); une infection généralisée avec le Kala Azar, qu'on se serve du virus (Nicolle) ou de doses suffisantes de cultures (Novy).

Quelques expériences d'immunisation homologue ou croisée, pratiquées par Manceaux et moi, précisent avec assez d'exactitude, à la fois la parenté et la dissemblance des deux leishmanioses; une atteinte expérimentale de bouton d'Orient vaccine contre le bouton d'Orient, mais ne confère qu'un certain degré de résistance vis-à-vis du Kala Azar; une première atteinte de Kala Azar vaccine contre le Kala Azar et contre le bouton d'Orient. Dans ces expériences, trop peu nombreuses pour que leur signification soit absolue, le virus du Kala Azar semble se comporter par rapport à celui du bouton d'Orient comme un virus fort par rapport à un faible.

Quoiqu'il en soit, il existe entre les deux maladies, naturelle et expérimentale, assez de différences pour que leurs rapports nous paraissent témoigner de plus que d'une simple parenté.

3. *Unité ou pluralité du bouton d'Orient.*—La leishmaniose cutanée de l'homme, en pays méditerranéen ou dans l'Orient, paraît, malgré la multiplicité des noms qui lui ont été donnés (clou de Biskra, de Gafsa, du Nil, bouton d'Alep, de Dehli, etc.), constituer une seule et unique maladie. Il appartiendra à nos collègues de l'Amérique du Sud de déterminer si le buba, l'espundia et autres ulcérations à leishmania, découvertes dans ces derniers temps, sont identiques ou non avec le bouton d'Orient de l'ancien continent.

II. ORIGINE DU KALA AZAR ET DU BOUTON D'ORIENT.

1. *Origine du Kala Azar.*—La rareté des cas de Kala Azar infantile en Tunisie, la présence, auprès des premiers enfants observés, de chiens malades ou morts ou disparus, la sensibilité du chien et du chien seul parmi les êtres vivants (les singes exceptés) au virus humain, m'ont fait penser qu'il existait sans doute à côté de l'homme un animal domestique jouant le rôle de réservoir de virus. C'est pourquoi, dès le début de mes travaux, j'ai pressenti et cherché l'existence à Tunis d'une leishmaniose naturelle du chien. Il m'a suffi de quelques semaines pour la constater.

Cette leishmaniose canine offre-t-elle avec la maladie humaine plus qu'une curieuse analogie? Le Kala Azar humain reconnaît-il, ainsi que je l'ai formulé le premier, une origine canine ou plutôt, car le chien dans ma pensée pourrait être fort bien contaminé par l'enfant au même degré que l'enfant par lui, les deux affections n'en forment-elles qu'une seule, commune aux deux espèces? La démonstration absolue n'en a pas encore été apportée. Les preuves, cependant, se font de plus en plus nombreuses pour nous en convaincre, en ce qui concerne du moins le Kala Azar de la Méditerranée; car, pour l'indou, je l'ai dit, tout ce qui regarde la sensibilité naturelle ou expérimentale du chien reste pour nous encore lettre morte.

Ces preuves sont les suivantes: La maladie naturelle du chien et la maladie expérimentale, due à l'inoculation à cet animal de l'un ou l'autre virus, humain ou canin, sont absolument identiques; les parasites semblables dans les cultures et dans les lésions; ils offrent, chez les chiens malades, les mêmes localisations. J'ai pu dernièrement, en collaboration avec Marthe Conor, réaliser avec le virus du chien l'infection du singe; chez le singe, la maladie est la même avec l'un ou l'autre des virus humain ou canin. Partout, dans le bassin méditerranéen (Tunisie, Algérie, Sicile, Italie méridionale, Grèce, Portugal), où l'existence du Kala Azar de l'homme a été décelée, on a trouvé la maladie naturelle du chien, lorsqu'on l'a cherchée. A Alger, quelque temps, la leishmaniose canine seule avait été observée; mon ami Edm. Sergent y a récemment découvert un cas de Kala Azar infantile. A Palerme, l'exception inverse, Kala Azar infantile sans leishmaniose canine vient d'être reconnue inexacte par celui-là même qui l'avait formulée (R. Jemma, communication privée). A Tunis, c'est la nationalité italienne qui montre le plus de cas de Kala Azar (les deux tiers); la maladie est très rare chez les musulmans; or, ceux-ci n'ont pas de chiens, tandis que les italiens vivent en état de promiscuité continuelle avec ces animaux. Enfin, les observations ne sont plus rares de cas de Kala Azar constatés chez l'homme et le chien d'une même maison; Basile et autres, en Italie, ont fait de ces

constatations; Edm. Sergent, près d'Alger, a trouvé dans la même habitation un enfant, un chien et même un tout jeune chat atteints. Si de telles observations ne sont pas plus fréquentes, cela tient à ce que la durée de l'infection chez l'animal est très longue, que les symptômes en sont longtemps, sinon toujours, nuls et que le chien, par conséquent, est généralement mort, guéri ou disparu lorsqu'on s'aperçoit que l'enfant est atteint. L'ignorance et la méfiance des propriétaires aussi sont tels, dans certains pays, qu'il suffit qu'on demande à voir le chien de la maison pour qu'on le cache ou qu'on vous en présente d'autres; le cas m'est souvent arrivé.

Pour trancher définitivement la question, il faudrait savoir, de façon certaine, par quel insecte la leishmania est transmise du chien à l'homme. J'ai émis l'hypothèse que cet insecte était la puce. Les expériences de Basile, qui est parvenu à faire passer l'infection du chien au chien par l'intermédiaire de *Pulex serraticeps* s'accorde parfaitement avec cette façon de voir; avant de conclure il serait bon pourtant de répéter les expériences de Basile et de tenter au moyen de la puce la transmission de la maladie d'une part du chien au singe, d'autre part de l'enfant ou du singe au chien. Le jour où ce progrès sera réalisé le problème de l'origine du Kala Azar méditerranéen pourra être considéré comme réalisé et les mêmes expériences devront être répétées aux Indes.

L'hypothèse du rôle de la punaise, émise par Patton, pour expliquer la transmission de cette maladie de l'homme à l'homme, reposait sur la ressemblance des formes parasitaires, constatées dans le tube digestif de cet insecte avec les leishmania. On sait aujourd'hui que de telles constatations sont banales et ne peuvent rien prouver. Seuls, des faits positifs de transmission expérimentale du Kala Azar permettront de déterminer, avec certitude, quel en est l'insecte vecteur.

2. *Origine du bouton d'Orient.*—La stricte limitation du bouton d'Orient, pour les pays de l'ancien continent, à une bande étroite, située dans des conditions géographiques exactement les mêmes et étendue du Maroc ou bassin du Gange, semble indiquer qu'un des facteurs nécessaires à la transmission du bouton d'Orient ne peut se rencontrer que dans cette zône précise. En Afrique mineure, la région à boutons d'Orient est située à la limite des territoires baignés par la Méditerranée et des premiers espaces sahariens, dans la zône des oasis montagneuses (Biskra, Metlaoui, Gafsa); les cas rencontrés en des régions différentes sont exceptionnels; les observations, signalées dernièrement en Italie, peuvent être dues à l'importation de leishmanioses sud-américaines.

Cette donnée géographique est capitale et devra servir de guide à ceux que le problème de la transmission du bouton d'Orient tentera. Il ne peut être question d'une différence de sensibilité entre les hom-

mes; toutes les races, surtout celles de récente importation, sont sensibles; quel est donc ce facteur particulier? Existe-t-il dans ces régions un animal qui joue le rôle de réservoir de virus ou bien une plante qui hébergerait le parasite (la découverte de leptomonas chez certaines euphorbiacées par Lafont ne doit pas être oubliée); est-ce seulement l'insecte vecteur dont la vie nécessite des conditions aussi strictes?

La solution du problème ne pourra être apportée que par une enquête sur place, établie en un point aussi limité que possible, afin de restreindre le nombre des espèces dont il faudra tenir compte. Nous avons commencé cette recherche et, bien qu'il ne nous soit pas encore permis de conclure, nous croyons que le facteur réservoir du virus (animal ou plante) peut être écarté. Le bouton d'Orient a une incubation et une durée si longues (la première peut atteindre, la seconde dépasse souvent six mois) qu'aucun réservoir autre que l'homme n'est utile pour la conservation du virus, de la saison où se prend le bouton d'Orient (août–septembre en Afrique mineure) à la même saison de l'année suivante. D'autre part, dans nos enquêtes, aucun des animaux domestiques ou sauvages des régions infectées ne s'est montré atteint de leishmaniose, localisée ou généralisée; la seule maladie particulière, que nous ayons découvert en ces régions, est la toxoplasmose du gondi; maladie très spéciale et très différente. C'est donc vers la détermination de l'insecte piqueur qu'il nous paraît utile de diriger actuellement les recherches.

Une enquête analogue devra être conduite, avec le même esprit, dans des Etats de l'Amérique du Sud, afin d'y découvrir l'agent de transmission des leishmanioses cutanées qu'on y rencontre.

RÉSUMÉ.

L'auteur établit, au cours de son travail, le bilan de nos connaissances sur l'origine et les rapports du Kala Azar et du bouton d'Orient; il montre les progrès accomplis et indique les lacunes à combler: (1) L'unité du Kala Azar humain ne sera prouvée que lorsque la maladie aura été reproduite chez le chien (animal réactif du Kala Azar méditerranéen ou infantile) avec le virus des Indes. Le Kala Azar et le bouton d'Orient doivent être considérés comme des infections tout à fait différentes; (2) l'identité du Kala Azar méditerranéen ou infantile et de la leishmaniose naturelle du chien n'est pas encore absolument démontrée; elle devient de plus en plus probable chaque jour; l'auteur rappelle les expériences récentes, dans lesquelles il a reproduit le Kala Azar chez le singe avec le virus du chien.

Des recherches suivies sont à instituer pour découvrir l'insecte qui transmet le Kala Azar; on devra tenter expérimentalement la trans-

mission de l'homme au singe et au chien, du chien au chien, du chien au singe. Cet insecte est très probablement la puce.

Une enquête, poursuivie dans un foyer limité de bouton d'Orient, pourra seule permettre de découvrir l'insecte qui transmet cette maladie; l'expérimentation en établira ensuite la preuve. Il ne semble pas qu'il y ait lieu de suspecter l'existence d'un réservoir de virus autre que l'homme.

THE ETIOLOGY, PREVENTION, AND CURE OF BERIBERI.

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Much confusion has been caused by assigning the name beriberi to classes of cases differing widely in their clinical manifestations. It is therefore necessary to make it clear that the disease which has been the subject of investigations carried out by us during the past six years is that form of multiple neuritis known as beriberi which occurs endemically in the Federated Malay States, Straits Settlements, and adjacent islands.

A survey of the voluminous literature which concerns itself with this disease will show not only that forms of polyneuritis of different etiology have been called "beriberi," but that even diseases of which neuritis may not be a prominent feature such as "epidemic dropsy," "ship beriberi," "Ceylon beriberi," and the like have been included under this name. It is not to be expected, therefore, that any single etiological factor will satisfactorily explain all the recorded outbreaks of so-called beriberi.

Epidemically and endemically the occurrence of beriberi is certainly greatest in those tropical and subtropical countries whose inhabitants partake of a diet in which rice forms an important and generally the staple constituent. The other articles of diet vary with the country, but rice varies merely in kind or quality and but little in regard to the quantity consumed.

In those countries where the disease is endemic the incidence has always been greatest among the poorer classes, inmates of public institutions and the like. Supporters of dietary hypotheses have therefore sought to account for the occurrence of the disease in that the diet consumed was deficient in some substance or substances essential for nutrition, and those workers who have incriminated rice consider either that a diet in which this article bulks largely is deficient in protein or fat, or that the rice has become harmful from the action of molds or other organisms.

The suggestion of a relationship between a rice diet and beriberi is a very old one, and there are numerous references to it in the literature of the disease. Many years ago the hypothesis was advanced that the cause of the malady was to be found in some poisonous properties developed in rice as the result of decomposition.

This conjecture was revived by Braddon, and he was the first to show the closeness of the relationship which exists in this country between the consumption of white rice as a staple article of diet and the disease beriberi. Of even greater importance was his demonstration of the fact that where the staple article of diet is rice which had been parboiled before husking, as used by the Tamil population, or rice as prepared by Malays, the disease does not occur.

In 1907–8 the writers carried out a series of observations designed to test the position of white rice as a causative agent in the production of beriberi. A detailed account of this inquiry has already been published and the results may here be summarized.

It was considered important that these observations should be made in a place hitherto free from the disease and where the operation of factors other than diet could be excluded or adequately controlled. Satisfactory conditions were obtained at Durien Tipus, in Negri Sembilan, where some 300 Javanese laborers were engaged in the construction of a new road through virgin jungle, remote from the complex conditions which interfere with observations in populous areas. The quarters occupied by these laborers were new, and the sanitary conditions were satisfactory.

The 300 laborers were divided into two parties of approximately equal numbers and were housed some miles apart. Before beginning the experiment an examination was made of each person, and the presence of cases of existing or recent beriberi was thereby excluded.

To one party white rice was issued as the staple article of diet, and to the other party parboiled rice. In about three months cases of beriberi began to occur among the members of the party on white rice. When a certain number of cases had been noted white rice was discontinued, and thereafter no cases occurred. No sign of the disease appeared among the control party on parboiled rice.

The conditions were then reversed. The party hitherto on parboiled rice was given white rice, and after a somewhat longer interval than in the first instance beriberi broke out in this group also. This outbreak ceased on discontinuing the issue of white rice. Again no sign of the disease appeared among the control party on parboiled rice. By the transfer of individuals suffering from beriberi and of whole groups in which the disease was occurring it was found possible to test the influence of place considered as a nidus of infection and also to test the possibility that the disease was communicable from one individual to another.

The average daily ration was as follows:

Rice	21.3 ounces (603 grams)
Dried salt fish	4.25 ounces (120 grams)
Onions	1.75 ounces (50 grams)
Potatoes	1.75 ounces (50 grams)
Coconut oil	.85 ounce (24 grams)
Coconut	1.50 ounces (42 grams)
Tea	.12 ounce (3.4 grams)
Salt	.1 ounce (2.8 grams)

The various articles composing the diet issued were submitted to analysis and the average of a considerable number of analyses was as follows:

	Moisture.	Protein.	Fat.	Carbohydrate.	Ash.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
White rice	13.85	7.45	0.17	78.02	0.51
Parboiled rice	14.03	7.8	.53	76.92	.72
Dried salt fish	48.1	35.7	2.96	.....	13.24
Onions	86.44	1.5	.28	11.28	.5
Potatoes	65.3	1.8	.2	31.66	1.04
Coconut	45.3	3.95	34.6	15.2	.95

Based on these analyses the diet issued to those on white rice as the staple was calculated to consist of: Protein, 91.45 grams; fat, 43.70 grams; carbohydrate, 499.16 grams; salts, 23.06 grams.

The diet issued to those on parboiled rice was calculated to consist of: Protein, 93.56 grams; fat, 45.88 grams; carbohydrate, 492.54 grams; salts, 24.33 grams.

It is generally accepted that the dietary requirements per kilogram of body weight are: Protein, 2 grams; fat, 1.5 grams; carbohydrate, 6 grams; salt, 0.5 gram. The average body weight of the people under our observation was 100 pounds, nearly; the diet should therefore contain: Protein, 90 grams; fat, 68 grams; carbohydrate, 272 grams; salt, 20 grams.

Comparison of this calculated standard diet with the diets consumed by the persons under observation will show that the issued diets can not be regarded as deficient save in respect of fats. This latter deficiency is, however, more than compensated for by the excess of carbohydrates. With a sufficiency of protein in a diet, fats and carbohydrates are to a great extent interchangeable, and the inhabitants of warm countries habitually consume less fat and more carbohydrate than do the inhabitants of cold countries.

The analyses of these foodstuffs did not include an estimation of the relative proportions of the inorganic salts composing the ash, nor did they take account of the manner of combination, organic or inorganic, in which these substances originally existed in the rice grain.

The conclusions arrived at as a result of this inquiry were stated as follows:

1. In the course of a systematic inquiry especially undertaken to test the position of white rice as a causative agent in beriberi, it was observed that 20 cases of this disease occurred among 220 people on white rice who were continuously present in the various parties during the course of the outbreaks. In the parties on parboiled rice during the same period and under similar conditions, among 273 people no sign of the disease appeared.

2. Since all cases presenting doubtful signs of the disease were excluded, we are of opinion that there were many other cases which in the ordinary routine of clinical practice would have been regarded as beriberi. Such cases only occurred among people who consumed white rice, and their inclusion would not strengthen the case for an infectious origin of the disease.

3. No case of beriberi occurred in any person who had been on white rice for less than 87 days.

4. Systematic examinations were made of the blood and urine of patients suffering from beriberi. Various methods of examination were employed, but in no case were organisms found other than those well known as the causative agents of other diseases.

5. In the course of the inquiry patients in various stages of beriberi were in contact with parties of men on parboiled rice. The results of observations made on such occasions furnished evidence that the disease is not a communicable one.

6. Removal of patients from the place where they had contracted the beriberi did not influence the progress of the disease, and the removal of entire parties from the place where the disease had occurred did not influence the progress of an outbreak so long as they continued on white rice. These observations suggest that place *per se* or considered as a nidus of infection has no influence upon the development of beriberi.

7. In three instances in which definite outbreaks of beriberi occurred among parties of men on white rice, substitution of parboiled rice was followed by cessation of the outbreak.

8. The occurrence of beriberi can not be attributed to deficiency in the diet issued in respect of either protein, fat, carbohydrate, or salts, as estimated by the methods in common use.

9. No evidence was obtained to show that any article of the diet other than white rice was responsible for the occurrence of beriberi.

10. Ankylostomes and other nematode worms were not found in a larger proportion of patients suffering from beriberi than in the general population under observation.

11. The general results support the view that the disease beriberi, as it occurs in the Malay Peninsula, has an intimate relationship with

the consumption of white rice and further research along these lines is justified.

RICE.

Throughout the course of the inquiry at Durien Tipus samples of the white rice issued were collected daily and forwarded to the Institute.

So far as the laboratory aspect of the question was concerned, therefore, an abundant supply of the rices connected with these outbreaks of beriberi was secured. In connection with the plan of work which we had formed we regard this circumstance as of the first importance. It could have led to no real advance in knowledge if analyses of a series of rices from various sources had been carried out without regard to their connection with outbreaks of beriberi. Having first shown that the consumption of a certain white rice was the cause of an outbreak of beriberi we were in a position to proceed further and by analysis of and experiments with that rice to seek for the explanation of this relationship. The continuity of work thereby established we believe to be one of the principal merits of the work.

The rice referred to as white rice is prepared in large power mills. The unhusked grain or padi is passed into a machine known as a "huller," where the husk is cracked off from the grain and thereafter removed by winnowing fans.

The grain still covered with its brown, yellowish, or other colored pericarp passes into a machine in which this structure, together with the layers immediately subjacent to it, are rubbed off.

From this machine the grain is passed into another where the process of polishing is completed; the grain is there deprived of the remains of the pericarp, the subpericarpal layers and germ; the final product is known as white or polished rice.

The materials detached in the process of polishing form what we have called the "polishings," and are in common use as a foodstuff for cattle and pigs.

Parboiled rice is prepared in the large power mills by soaking the grain in water for 24 to 48 hours; the water is then run off and the grain transferred to cylinders which are lightly covered and steam is passed through the contents for five or ten minutes. The grain is thereafter transferred to open paved courts and dried in the sun. The husk is now more readily detached than in the untreated grain but the contents of the grain have been rendered tough and semi-translucent.

The dried parboiled grain is husked in the ordinary way. Thereafter the grain is deprived of its pericarp in a polishing or pearling machine and as no amount of polishing can render the parboiled

grain white the process is seldom carried beyond a degree sufficient to complete the removal of the pericarp.

Malay or native rice is prepared by primitive processes of pounding or winnowing. The removal of the subpericarpal layers by these methods is incomplete.

HISTOLOGY—COMPARISON OF VARIOUS RICES.

A process was devised whereby entire sections of these various rices could be obtained, and by suitable methods of staining it was shown that a transverse section of a rice grain from which the paleæ (husk) have been removed exhibits three zones:

1. The outer thin pericarp.
2. The layers subjacent to the pericarp, the subpericarpal layers, composed of cells filled with aleurone and fat and comparatively free from starch grains.
3. The remainder of the section, constituting the major part, is composed of cells filled with starch grains.

Fat in the grain is practically confined to the cells of the subpericarpal layers.

It was further demonstrated that polished rice differs from parboiled rice in that the subpericarpal layers are removed in the case of the former grain and retained in the case of the latter grain, provided that it has not been subjected to excessive pearling or polishing; such a rice we group with the unpolished rices.

In the case of Malay rice the extent to which the subpericarpal layers are removed depends on the amount of pounding and attrition to which the grains have been subjected.

In the rices we refer to as unpolished the pericarp has been removed. The consideration of this structure as a factor in the etiology of beriberi is thereby excluded.

Unpolished rices differ from polished rices only in respect of the subparicarpal layers which are present in the case of the former and absent in the case of the latter.

In none of the numerous sections from various kinds of rice were molds or fungi recognized.

RICE AND THE NUTRITIVE HYPOTHESIS.

In view of the evidence which shows that the continuous consumption of white or polished rice—that is, rice from which the subpericarpal layers have been removed by polishing—causes beriberi, and in view of the histological differences demonstrated between polished and unpolished rices, the suggestion presented itself that by the removal of the subpericarpal layers the grain is deprived of some important nutritive substance or substances.

Analyses were made of the various kinds of rice, and for comparison the average results of these analyses are given here:

	Protein.	Fat.	Carbohydrate.	Ash.	Moisture.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Unpolished rice	9.0	1.65	75.52	1.08	12.75
Polished rice	7.7	.25	77.23	.52	14.3
Parboiled rice	7.8	.50	76.88	.82	14.0
Malay rice	7.3	.63	77.19	.88	14.0

The average daily ration of an oriental laborer contains 1.3 pounds of rice.

Dealing first with the differences in respect of proteins, that between parboiled and polished rices is small and within the limits of experimental error, but admitting the difference to be a real one and assuming all the protein in rice to be available for purposes of nutrition, a person receiving parboiled rice would consume 9 grains more protein than one receiving polished rice, and a person receiving Malay rice would consume 36 grains less than the one on polished rice. An explanation on this basis would therefore not be in accordance with the effects produced.

The amount of fat ingested in a ration of 1.3 pounds of rice would be 45.5 grains in the case of parboiled rice, 22.75 grains in the case of polished rice, and 57.25 grains in the case of Malay rice, differences which are appreciable and in accordance with the histological findings, but which do not appear to furnish an adequate explanation if the fats be regarded merely as the esters of fatty acids.

The differences in respect of carbohydrates is small; parboiled rice contains more sugar than polished rice or Malay rice, but it did not appear that these differences would furnish an explanation.

The ash furnishes a most imperfect idea of the salts contained in rice, all the organic salts being reduced to carbonates, but there is apparently a very constant difference in the amount of ash, which is lower in the case of polished rice than in unpolished, parboiled, or Malay rices. A person receiving parboiled rice would consume material yielding 74.6 grains of ash, and a person receiving polished rice would consume material yielding 47.3 grains of ash. The difference of 27.3 grains is by no means inconsiderable, more especially when it is remembered that small amounts of certain inorganic and organic salts have a great importance in the economy.

We were not in a position to separate the various salts occurring in these rices, and, moreover, as none of the other constituents estimated had furnished an explanation for the difference in results produced by these various rices when consumed as the staple of diet, it seemed possible that even if we did accomplish this the results might be unsatisfactory.

RICE AND THE POISON HYPOTHESIS.

It was decided to carry out investigations with a view to determining whether a poison or poisons existed in polished rices known to have been associated with outbreaks of beriberi.

The white and the parboiled rices milled in this country have a common origin in respect of the grain from which they are prepared; therefore any deleterious substances present in the white rice must have developed after polishing and have resulted from the action either of enzymes or of microorganisms, failure to find these latter notwithstanding.

It has been suggested that the removal of the pericarp and subjacent layers deprives the grain of protective structures and facilitates the action of microorganisms.

Rice is washed before cooking, and the cooking involves exposure to a temperature of 212° F. or thereabouts for some time; therefore the ingestion of living organisms with the rice may reasonably be excluded; their activity is confined to the interval which elapses between the milling and the cooking of the rice, and the deleterious substances produced by them must be capable of withstanding prolonged exposure to moist heat.

It might be suggested such harmful substances would be removed in the preliminary washing, but the extent to which this washing is carried out varies greatly and not infrequently it is done in a perfunctory manner.

In the initial experiments for the isolation of a poison the white rice was macerated, or boiled and macerated, in water acidulated with a small quantity of acetic acid, but on account of the rapidity with which molds developed in the mixture and the difficulty of separating the fluid after maceration these experiments were discontinued.

In the next series of experiments alcohol acidulated with acetic acid was employed. The alcoholic extracts were concentrated *in vacuo* and finally freed from alcohol by exposure in evaporating basins to a moderate heat. The extracts were then examined and treated in various ways for the isolation of poisons, but although numerous examinations and experiments were made no poison was ever isolated. The failure to obtain a positive result did not exclude a poison, but when it is remembered that a large number of methods were employed it is suggestive that further work along these lines was unlikely to be profitable. We had already noted nutritive differences in the rices which in the light of our then knowledge we did not consider adequate to furnish the explanation sought for, but failure to find a satisfactory result on a poison hypothesis caused us to turn our attention to further experiments on the nutritive hypothesis.

Chemical methods having failed there remained animal experimentation, and it was anticipated that by feeding various animals on rice and rice products information of value might be obtained.

FEEDING EXPERIMENTS ON ANIMALS.

It was designed in the first instance to carry out experiments with anthropoids which, we considered, were more likely to yield information of value than experiments with animals lower in the zoological scale. Though anthropoids of several species are comparatively common in this country, it was not without considerable difficulty that we were enabled to secure a sufficient number of them to make the experiment. Finally six were obtained. These were confined in separate cages and received cooked white rice and water. The results were unsatisfactory, as shortly after the beginning of the experiment several of the animals refused to eat the rice and all of them died of dysentery.

Six monkeys were fed in a similar manner. All of them became very much emaciated and five died after three months, apparently of inanition. No degenerative changes were found in the nerves.

Experiments were next carried out with fowls, which previous observers had shown to be readily susceptible to a form of polyneuritis following the ingestion of certain foodstuffs.

A preliminary experiment was made by feeding 12 fowls on white rice which was known to have been associated with an outbreak of beriberi. A control group was fed on parboiled rice.

The fowls were confined in separate cages and were in all respects under identical conditions. The cages, which were open at the bottom, rested on a hard layer of clay the surface of which was covered with sand, and though the possibility of the fowls obtaining such things as worms and the like was not excluded, the conditions were more natural than if the cages had rested on a wooden or concrete floor.

In addition to rice, which was supplied twice daily at 10 a. m. and 3 p. m., a small tin filled with water was placed in each compartment. The original weight of each fowl was noted and thereafter they were weighed once weekly at 12 noon.

In the group of fowls on white rice the first sign of disease was noted in a fowl on the twenty-sixth day of the experiment. In the morning it was observed that there was weakness of the leg muscles and consequent uncertainty of gait. When stimulated it would move about in an uncertain way. Examination of the blood failed to reveal the presence of any parasite or other abnormality.

Two days later the paralysis had advanced very considerably. It was quite unable to walk and the wing muscles were also involved so that these drooped. The diet was now changed to parboiled rice and padi, but it was unable to eat and on the ninth day of the illness the fowl died. On post-mortem examination no microscopic change was noted, there was no effusion into the serous cavities, and no marked dilatation of the heart. The principal nerves of the legs

and wings were preserved and on subsequent examination showed characteristic Wallerian degeneration.

To test the possibility of the disease being a communicable one and unconnected with the diet, a healthy fowl on parboiled rice was transferred to the cage occupied by the fowl suffering from polyneuritis. This fowl was continued on parboiled rice as heretofore and remained healthy at the conclusion of the experiment five weeks later.

Another fowl developed the disease on the twenty-eighth day of the experiment. At 10 a. m. it was noticed to be unsteady, but was able to walk about. Two hours later paralysis had extended greatly and the fowl rolled about in the cage in an endeavor to recover the upright position. The head was markedly retracted, and when extended immediately returned to this position. The wings were drooping. An attempt was made to feed the fowl with padi, but it was unable to eat, owing apparently to the spasm of the neck muscles. On the following day the animal died.

This type of case, which was of the convulsive form of polyneuritis of fowls, was not infrequently observed throughout the experiments. It was less common, however, than the type in which simple paralysis was the principal feature.

On the day of onset of the disease a fowl from the group on parboiled rice was placed in the cage to test the possibility of infection. The result in this, as in the previous test and in numerous subsequent tests, entirely negatived the possibility of the disease being communicable by contact or through intermediate hosts, as ticks or lice.

Within eight weeks, 8 of the 12 fowls had developed polyneuritis. Though the experiment was continued for four weeks longer, the other four fowls remained healthy.

The group of fowls on parboiled rice originally numbered 8. This number was afterwards increased as fowls from this group were transferred to cages occupied by fowls suffering from polyneuritis. In all, 12 fowls were under observation for periods varying from 5 to 13 weeks. At the conclusion of the experiment all remained healthy.

It was thus shown that fowls were sensitive to differences between these two kinds of rice, and the occurrence of polyneuritis furnished a reaction which has proved of the utmost value.

In this, as in subsequent experiments, every possible effort was made to transmit the disease to the fowls of the control groups, but with uniformly negative results.

The previous researches had shown conclusively that white rice was either the vehicle by which the agent producing beriberi was introduced into the body or that white rice was deficient in some substance or substances essential for metabolism. Parboiled rice

neither conveyed this disease-producing agent nor was it deficient in the substance or substances essential for metabolism.

By following up the results of these initial experiments on fowls we thought that it might be possible to determine the factors of importance in the etiology of beriberi. In the case of poisons it should be possible to extract them from white rice and render it innocuous; if it were a deficiency it should be possible to supplement that deficiency either by the addition of the substances removed in the process of polishing, or by the addition of substances extracted from parboiled or unpolished rice.

THE POISON HYPOTHESIS.

The chemical experiments had not been successful in isolating a poison recognizable by chemical means, and the inoculation experiments performed on guinea pigs, rabbits, and monkeys, with various substances isolated from white rice, yielded no satisfactory result.

The disease which occurs among fowls fed on white rice provided a means of carrying out further experiments on the poison hypothesis. The existence of a poison or poisons in white rice had not at this time been definitely excluded, and the further possibility remained that the harmful substance or substances could not be detected by any of the chemical reactions employed. Experiments were therefore undertaken with products extracted from white rices. In the first of these, white rice obtained from the supplies issued during the inquiry at Durien Tipus was used. The rice was thoroughly exhausted by maceration and percolation with cold 94 per cent alcohol. After percolation was complete the rice was freed from alcohol by expression and dried in the sun.

Five fowls were fed on the exhausted rice and three developed polyneuritis within five weeks.

It appeared therefore that percolation with cold alcohol had failed to dissolve out the hypothetical poison.

In the second experiment rice from the same source was extracted with hot 94 per cent alcohol.

Four fowls were fed on the exhausted rice and two developed polyneuritis. Percolation with hot alcohol had also failed to dissolve out the hypothetical poison.

The bulk of the extracts from the rices had been employed in the chemical experiments, but a quantity of the extract prepared by means of hot alcohol remained. This alcoholic extract had most of the alcohol removed from it by distillation *in vacuo*, and was finally freed from alcohol by exposure in shallow basins at a low temperature. The alcohol-free extract was emulsified in distilled water and two fowls fed on parboiled rice received in addition daily an emulsion of the extract representing that obtained from 100 grams of white

rice. The experiment was continued for 51 days. Both fowls gained in weight and showed no signs of any disease.

These experiments showed that no alcohol soluble poison was contained in white rice.

In order to control the results of experiments with products obtained by extracting white rices with alcohol, parboiled rices were exhausted with hot 94 per cent alcohol.

Four fowls were fed on the exhausted rice. In the fifth week one of them developed a condition indistinguishable clinically from other cases of polyneuritis in fowls fed on white polished rice.

This result indicated that some protective substance ordinarily present in parboiled rice had been removed by treatment with hot 94 per cent alcohol, and further experiments were undertaken to test the value of this suggestion.

Twelve fowls were fed on the exhausted rice; two developed polyneuritis within five weeks and two more in the sixth week. Fowls fed on white rice to which was added daily the extract from 83 grams of unpolished parboiled rice daily all remained healthy.

It was concluded from these experiments that unpolished rice contained important physiological substances soluble in hot alcohol of 94 per cent strength.

By similar experiments, but using proof spirit in place of 94 per cent alcohol, it was shown that the physiologically important substances were soluble in the weaker alcohol.

No evidence was obtained from these experiments that white (polished) rice ever contained a beriberi producing agent. The results taken in conjunction with the histological findings suggested that by the removal of the subpericarpal layers of the grain in the process of milling, the grain is deprived of some substance or substances of high physiological value.

In subsequent experiments this conclusion was abundantly confirmed.

EXPERIMENTS WITH VARIOUS WHITE RICES.

Experiments were carried out with white polished rices from various sources.

In the first experiment of the series the white polished rice used in the inquiry at Durien Tipus was employed. Of the four fowls used for the experiment three developed polyneuritis within four weeks.

The second experiment of the series was one designed to test the effect of feeding 12 fowls on a white polished rice, while at the same time another group was fed on the original partially husked padi from which this white rice had been prepared, and yet another on the white polished rice to which the substances removed in the polishing process had been added. In the group under review, those to which

white rice alone was given, 1 fowl died on the third week without signs of polyneuritis—6 others developed polyneuritis within 5 weeks.

The third experiment of the series was carried out to test whether, as alleged by Bradden, rice that had become stale on account of changes occurring in it in the interval between milling and consumption was more harmful in its influence than freshly milled rice. An assistant was stationed in Singapore who forwarded to the laboratory daily by the most expeditious route a quantity of white polished rice milled on the day of dispatch. Of 12 fowls fed on this rice 5 developed typical polyneuritis within 4 weeks, a result similar to that in experiments in which white polished rice varying in age from a few months to 2 years was employed.

Experiments were carried out with white polished rice of the best quality purchased locally. In one of these 9 fowls out of 12 developed polyneuritis within nine weeks, seven cases occurring before the end of the fifth week. In the other, 11 cases among 12 fowls occurred within five weeks. It appeared in these experiments that certain fowls were more resistant than others to the injurious influence of white rice. The reason for this was not ascertained though the observation was made that such fowls were commonly the younger members of the group, while those who succumbed most quickly were the full-grown fowls who consumed a large quantity of rice. It was also noted that after two or three weeks fowls on white rice usually showed a disinclination to eat.

These observations, which are similar to those made when human beings were under observation, appear to us to be irreconcilable with the idea of simple deprivation of proteins, fats or carbohydrates being the final explanation of the occurrence of the disease.

In every case of polyneuritis, Wallerian degeneration was demonstrated microscopically in the nerves and the changes are identical in every way with those found in the peripheral nerves in beriberi.

STARVATION AND FORCED-FEEDING EXPERIMENTS.

As has been already stated, it was usually found that after the first few weeks on a white-rice diet, most fowls showed a disinclination to eat. Commonly, also, fowls lost greatly in weight before the development of polyneuritis, but these were by no means constant features.

Despite the fact that groups of fowls on a diet of padi unpolished rice or parboiled rice usually continued to eat well throughout, the suggestion was raised that on account of the monotonous nature of a diet of white rice the fowls ceased to eat and that polyneuritis was a result of partial simple starvation. This was at all events a point that required to be tested and accordingly experiments were carried out.

In the first experiment of this series 4 fowls hitherto feeding on padi were employed. Nothing but water was supplied. The bottom of the cage being open, they had access to such food, insects, and the like as could be obtained there. This condition of affairs was, however, controlled by the fact that all fowls, including those on white rice, were similarly circumstanced. Within four weeks all the fowls had lost greatly in weight and were weak but none of the signs constantly associated with polyneuritis had shown themselves. Within a similar period some fowls of a group fed on white polished rice had invariably shown signs of polyneuritis.

The number of fowls in the first experiment was of course too small to furnish any definite information, and a second experiment with 12 fowls was begun. Within five weeks 2 of the fowls composing this group had died and 2 others were killed when their condition was such that it was apparent they would die within a few hours. None had showed any clinical signs of polyneuritis and careful examination of the nerves showed no characteristic degeneration changes.

A third experiment was carried out with a similar result.

It was concluded that polyneuritis of fowls is not due to general deprivation of food but to deprivation of some particular element in a diet of white polished rice.

In order to test further the correctness of the conclusion, Dr. Fletcher carried out an experiment in which two groups of 6 fowls were fed on white rice.

To the first group 30 grams of white rice was supplied twice daily in the ordinary way and 4 developed polyneuritis. To the second group 30 grams of white rice was passed into the crop twice daily and all of them developed polyneuritis.

The result showed that there was no difference between the two groups as to their liability to develop polyneuritis. Polyneuritis, therefore, can not be due to simple deprivation of food.

EXPERIMENT WITH UNPOLISHED RICES.

During the course of the experiments it was observed that fowls always remained in health on padi, and fowls suffering from polyneuritis almost invariably recovered when given padi. An experiment was carried out in which a partially husked rice known commercially as "cargo rice" was employed. About half the grains are denuded of husk. This experiment was carried out as a preliminary to certain experiments in which this same product, after milling in various ways, was employed. These latter experiments will be referred to later.

In the experiment now under review 12 fowls were fed on partially husked rice for six weeks and all remained in good health at the conclusion of the experiment.

Other experiments in which padi and unpolished rices were employed confirmed the observation that fowls remained in health when fed on rice which still retained its subpericarpal layers.

EXPERIMENTS WITH PARBOILED RICE.

Experiments with parboiled rice were carried out simultaneously with and for longer periods than experiments with white polished rice as controls for the results obtained in the latter groups.

The experiment first to be mentioned was one undertaken at the beginning of the series. In it 5 fowls only were employed. All maintained health and weight during 15 weeks, cooked unpolished parboiled rice only being supplied throughout. It was thus shown that, in the conditions under which our experiments were carried out, a diet of parboiled rice and water was sufficient to maintain fowls in health and weight over prolonged periods; and this result, repeatedly obtained by similar experiments, was regarded as an adequate control to results obtained in shorter periods, 5 weeks or less.

EXPERIMENTS WITH MALAY RICE.

It is conceded by all those whose knowledge of this country and of its people enables them to speak with authority that among Malays under primitive conditions beriberi is very rare.

The first experiment in this series was one in which a rice prepared from a locally grown padi was employed.

A Malay woman prepared rice from this padi after the manner and with the primitive implements used by Malays in their own villages.

Twelve fowls were employed for this experiment. All remained healthy with the exception of one, which on the forty-second day developed polyneuritis.

In the second experiment in this series, which was one of a group of experiments to which particular attention will be directed later, Malay rice was prepared from a partially husked padi imported from Indo-China.

The method of preparation of this rice was similar to that employed in the preceding experiment.

As the supply of this product was limited, only 8 fowls were employed for this experiment and it lasted only 5 weeks. All the fowls remained normal throughout this period.

The occurrence of a case of polyneuritis in a fowl fed on Malay rice calls for some comment. It is the single instance throughout these experiments, in which hundreds of fowls have been employed, in which polyneuritis developed in a fowl on a diet other than white polished rice. The clinical appearances were in all respects identical with those of other cases of polyneuritis, and we do not assign to the

case an origin other than dietary. It appears that even the limited amount of polishing to which Malay rice is subjected in its preparation may on occasion be harmful.

EXPERIMENTS WITH POLISHINGS.

As it now appeared that the harmfulness of a rice diet varied directly as the extent to which the rice had been milled, it was determined to test this hypothesis further by adding to a white polished rice, which when given alone had been shown to be harmful, a quantity of polishings equal in amount to that which had been milled away. The miller estimates that from 40 parts of unhusked rice there are produced 10 parts of bran, 25 parts of rice, and 5 parts of polishings; 16 per cent of the husked grain is thus lost in polishing. An actual weighing of some thousands of grains of unpolished and polished rice from the same lot of padi showed that the loss was about 10 per cent.

In the first experiment of this series the white polished rice selected was the same sample as that employed in a previous experiment and which when fed alone had resulted in 6 cases of polyneuritis among 12 fowls in 5 weeks.

The rice polishings were from the same sample. They were sifted in order to remove husks and broken rice and given in the form of an emulsion with distilled water.

During the first and second weeks of the experiment an amount of emulsion equal to 10 grams of polishings was given daily for a fowl eating 60 grams of rice.

During the third week 8 grams of polishings were given daily, during the fourth and fifth weeks 6 grams, during the sixth week 4 grams, and during the seventh week 3 grams were given.

Up to the seventh week all the fowls gained slightly in weight. In the seventh week there was a moderate loss amounting to 2.6 grams per kilogram of body weight.

In the seventh week there was a moderate loss—2.6 grams per kilogram. It was concluded, therefore, that the amount of polishings necessary to add to 60 grams of this sample of white polished rice to maintain the normal nutritive equilibrium was between 3 and 4 grams—say, 3.5 grams. This amount being added, there was in the eighth week a slight gain in weight in the whole group.

It was considered desirable to repeat this trial with a rice from a beriberi outbreak. An experiment was therefore planned in which 8 fowls were fed on the Durien Tipus rice, each alternate fowl receiving in addition 3.5 grams of polishings.

In 4 weeks 2 of the fowls fed on rice alone had developed polyneuritis and all 4 had lost weight, while the 4 fowls which were given

polishings in addition remained healthy, and at the conclusion of the experiment all had gained in weight.

The conclusion was now arrived at that certain essential substances are lacking in the case of white polished rice and that the addition of rice polishings to a diet of white polished rice prevents the occurrence of polyneuritis in fowls.

THE PHOSPHORUS CONTENT OF RICE AS AN INDICATOR OF THE EXTENT TO WHICH RICE HAS BEEN POLISHED.

Having proved that the occurrence of polyneuritis in fowls and of beriberi in man is due to the consumption of rice from which the subpericarpal layers have been removed by the process of polishing, that such rice is equally harmful, whether freshly prepared or stored for months, the development in it of a poison is excluded, and it is necessary to revert to the consideration of the results obtained from analyses of rices.

A diet of polished rice made up with polishings to the necessary amount for the maintenance of weight and health approximates in composition to one of unpolished rice, and it might therefore be inferred that the deficiency of white rice in respect of proteins, fats, and salts was accountable for its harmful results. The protein content of polished rice differs only by a slight amount from that of two parboiled rices which were proved harmless, and, allowing for experimental errors, the differences are apparently insufficient to account for the results. In respect of fat the polished rice is poorer, but the difference is a small one and, as has been previously stated, can hardly account for the difference in the results. The ash gives a very imperfect representation of the salts present, but there is a considerable difference in the amount of ash present in the unpolished and polished rices, yet even the amount present in the latter rice exceeds that obtained from one of the parboiled rices.

Now, in the case of parboiled rice extracted with hot alcohol (94 per cent), the amount of fat removed is relatively great, but of proteins and ash relatively small, and in the case of parboiled rice extracted with proof spirit similar results are observed.

The proteins were invariably estimated by the Kjeldahl process, and, allowing for the possibilities of experimental error, the differences in respect of proteins as determined by this method will not explain the results.

The question of the carbohydrates can not seriously be considered, as these were calculated by difference.

These methods of analysis failed in every way to explain the results, and it was necessary to employ other methods. It was suggested to one of us by Dr. Mott that the deficiency of white rice in

lipoids might be of importance, and various attempts were made to determine the amount of these present in rices, but the process was a tedious one and the results not satisfactory. It was decided, therefore, to estimate the phosphorous pentoxide content of the various rices.

Nearly 200 estimations have been made, and the results were invariably recorded on the undried material. The percentage of moisture in various kinds of rice does not vary greatly, being usually from 13 to 14 per cent or thereabouts, and it was found that the percentage calculated on the dried material did not yield any information other than that obtained by calculation on the undried material.

Polished white rice, of the kind commercially known as Siam rice, yields on an average 0.26 per cent of phosphorus pentoxide, and is the variety usually associated with severe outbreaks of beriberi.

Polished white rice of the kind commercially known as Rangoon rice yields on an average 0.328 per cent of phosphorus pentoxide, and the incidence of beriberi among rice eaters is less with this kind of rice than the former.

Malay rice yields on an average 0.38 per cent of phosphorus pentoxide, and the incidence of beriberi is still less with this kind of rice.

Parboiled rice yields on an average 0.415 per cent, or over, of phosphorus pentoxide, and beriberi does not occur when this kind of rice is eaten.

Unpolished rice yields on an average 0.54 per cent of phosphorus pentoxide, and can never produce beriberi.

Local millers have endeavored to improve the appearance of parboiled rice, and this result some of them have sought to achieve by polishing, or, as it is technically called, "pearling." Attention has previously been directed to the difficulty of accomplishing this on account of the toughening of the grain by soaking and steaming, but by the use of stone polishers it is possible to remove a considerable amount of the subpericarpal layers, with consequent diminution of the phosphorus pentoxide content. We recently examined such a rice which yielded only 0.34 per cent of phosphorus pentoxide.

Another sample of parboiled rice was examined after hulling and yielded 0.6 per cent of phophorus pentoxide. After pearling once it yielded 0.5 per cent, and after pearling twice it yielded 0.4 per cent.

An unpolished rice yielding 0.56 per cent of phosphorus pentoxide after polishing in the ordinary way yielded only 0.26 per cent.

Average results of all estimations.

	Percentage of P_2O_5.
Polished rice (Siam)	0.26
Polished rice (Rangoon)	.328
Malay rice	.38
Parboiled rice	.415
Unpolished rice	.54

Fowls fed on polished rice and receiving polishings in sufficient amount are receiving a dietary which approximates in its content of phosphorus pentoxide to a diet of unpolished rice. The harmfulness of rice is therefore in inverse proportion to its phosphorus pentoxide content, and in direct proportion to the extent of which it has been polished.

None of the rices connected with outbreaks of beriberi yielded more than 0.26 per cent of phosphorus pentoxide. The rices substituted for these and which were effective in preventing the continuance of the outbreaks yielded not less than 0.4 per cent of that substance.

FURTHER EXPERIMENTS ON THE VALUE OF POLISHINGS.

The results of numerous experiments had now made it clear that the addition of rice polishings to a diet of white polished rice prevented the harmful effects of such a diet. The further researches consisted in an endeavor to determine the nature of the substances in rice polishings which were responsible for this result.

In order that the results in the various experiments of the series should be comparable, it was considered desirable that the various rices and rice products employed should be derived from the same lot of padi. Accordingly we obtained from a rice mill in Singapore the materials desired:

(1) A quantity of the rice as it passed from the huller to the polishing machines. At this stage the grain is deprived of the husk only (unpolished rice).

(2) A quantity of the rice after having passed through the polishing machines (white polished rice).

(3) A quantity of the rice polishings or rice meal collected from the polishing machines.

A preliminary series of experiments was carried out to test the value of these various foodstuffs when fed to fowls.

In the first experiment the unpolished rice was employed. It was shown that this foodstuff, in addition to which only water was supplied, sufficed to maintain fowls in good health for many weeks.

In the next experiment the white polished rice was employed. Within three weeks 6 fowls out of a total of 12 fowls included in the experiment suffered from polyneuritis.

In the third experiment the white polished rice diet identical with that in the preceding experiment was employed. In addition each fowl received daily 5 grams of sifted rice polishings emulsified in water. All the fowls remained healthy.

This series of experiments confirmed results previously obtained and showed that these materials were suitable for employment in the further researches which it was proposed to undertake.

THE EFFECT OF EXPOSURE TO HIGH TEMPERATURES.

Before proceeding with the experiments for the isolation of the physiologically important substance from polishings, it was decided to test the effects of exposure to steam under pressure, because Grijns, Holst, and Frohlich have shown that various meats and vegetables are injuriously affected by exposure to high temperatures.

Unhusked rice, which had been inclosed in cloth bags and heated for one hour in the autoclave at 120° C., was given to 6 fowls and 5 of them developed polyneuritis.

Husked unpolished rice was placed in porcelain dishes and heated for one hour at 120° C. The product was fed to 4 fowls and 2 of them developed polyneuritis.

In certain large institutions rice is cooked by steam under pressure. In this way large quantities are dealt with economically.

Unpolished rice cooked in this way and as issued to the inmates of a large institution was given to 6 fowls and 3 developed polyneuritis.

Methods of analysis involving exposure of the materials to high temperatures could not therefore be employed.

EXPERIMENTS TO ISOLATE THE PROTECTIVE SUBSTANCES CONTAINED IN RICE POLISHINGS.

From this point researches were carried out for the isolation of the physiologically important substance.

For the purpose of testing the value of the various materials, fowls weighing 1,200 grams or thereabouts were employed.

As the result of a series of observations it had been determined that fowls weighing from 1,200 to 1,400 grams required about 60 grams of unpolished rice daily, and, if fed on 60 grams of the polished rice used in these experiments they required in addition 5 grams of sifted polishings for the maintenance of weight and health.

All the products employed, unpolished rice, polished rice, polishings, etc., were derived from the same lot of padi.

For purposes of comparison the following results of analyses are given:

	Protein.	Fats.	Carbohydrates.	Ash.	Moisture.	Percentage of P_2O_5.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
Polishings (sifted)	13.7	14.16	52.77	7.54	11.83	4.1
Unpolished rice	9.0	1.65	75.52	1.08	12.75	.56
Polished rice	8.6	.22	76.23	.6	14.35	.26

When the composition of these articles is calculated on dried materials the differences are rendered more striking and accurate, and when in a similar manner the composition of a diet made up of

60 grams of polished rice and 5 grams of polishings is calculated it will be seen how closely such a diet approximates to one of unpolished rice.

Calculated on dried materials.

	Protein.	Fats.	Carbohydrates.	Ash.	Percentage of P_2O_5.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	
Polishings (sifted)	15.5	16.0	60.0	8.5	4.65
Unpolished rice	10.3	1.89	86.58	1.23	.64
Polished rice	10.0	.25	89.05	.7	.3
Ration 60 grams polished rice plus 5 grams polishings contains	10.4	1.5	86.8	1.3	.64

Polishings when fresh are neutral in reaction, but on keeping they become acid. This change does not impair their efficiency however, and polishings which have been stored with ordinary care for months are quite as valuable as the fresh materials. The ordinary process of cooking does not impair the value of polishings. For these reasons it is considered that the essential substance or substances are not unstable.

EXPERIMENTS TO DETERMINE THE VALUE OF FAT IN POLISHINGS.

Fat in the rice grain is mostly confined to the subpericarpal layers. Unpolished rice is therefore richer in fat than polished rice and polishings are very rich in fat.

To determine the value of this fat, a quantity of sifted polishings was packed in a percolator and percolated repeatedly with petroleum ether. In this way the amount of fat in the polishings was reduced from 14.16 to 0.6 per cent. The fat-free polishings were dried by exposure to the sun until free from petroleum ether.

Twelve fowls were fed on polished rice and received in addition daily 4.5 grams of fat-free polishings, being the approximate equivalent of 5 grams of sifted polishings. The fowls remained healthy and maintained their weight just as had been the case when fowls received polished rice and sifted polishings. The nonimportance of fat was therefore decided and its exclusion from the number of possibilities was of the utmost value.

EXPERIMENTS WITH THE SUBSTANCES SOLUBLE IN 0.3 PER CENT HYDROCHLORIC ACID.

Estimations of the percentage of phosphorus pentoxide in rices had consistently shown their value as indicators of the liability or otherwise of a given rice to produce polyneuritis. Thus the higher the percentage of phosphorus pentoxide contained in a rice the less liable was that rice to produce polyneuritis when fed to fowls.

The unpolished rice employed contained 0.56 per cent phosphorus pentoxide and did not cause polyneuritis. The polished rice contained 0.26 per cent phosphorus pentoxide and invariably caused polyneuritis, while washed rice containing 0.22 per cent phosphorus pentoxide was more harmful than the unwashed polished rice. This suggested the probability that the essential substance was one containing phosphorus.

Now it was known that a large percentage of the phosphorus compounds present in rice polishings were soluble in 0.3 per cent hydrochloric acid.

Polishings were therefore exhausted by means of 0.3 per cent hydrochloric acid.

The acidulated extract was nearly neutralized with sodium carbonate and the volume adjusted so that 30 cubic centimeters represented the substances dissolved out from 5 grams of polishings. Twelve fowls were fed on polished rice and each received daily 30 cubic centimeters of this liquid. Cases of polyneuritis did not occur.

Twelve fowls were fed on polished rice and each received daily a dose of the exhausted polishings. Cases of polyneuritis occurred.

When 100 grams of polishings are extracted with 0.3 per cent HCl, 26 grams of solids pass into solution. In this 26 per cent of the original polishings are contained the physiologically active substances.

EXPERIMENTS WITH PHYTIN.

It having thus been made clear that the substances of physiological importance in polishings were removed unchanged by extracting with 0.3 per cent HCl, the further research consisted in division of this fraction by various methods.

Of the substances contained in rice polishings which are soluble in 0.3 per cent hydrochloric acid an important constituent is the phosphorus compound phytin.

By the use of copper acetate it was determined that unpolished rice contained 1.07 per cent of phytin and that polished rice contained only a trace of this substance.

Phytin for experimental purposes was prepared by the following method: Sifted polishings were mixed with 0.3 per cent hydrochloric acid in the proportion of 300 grams of the former to 2,000 cubic centimeters of the latter, the mixture was stirred throughout the day and on the following morning was filtered through a Buchner's filter. The clear yellowish filtrate was mixed with one and a half times its volume of 95 per cent alcohol, which produced a white precipitate of phytin; the mixture, of proof-spirit strength, was allowed to stand for a few days. The precipitate was collected, washed with strong alcohol to free it from acid, and dried in a vacuum desiccator. A friable cake of phytin was obtained readily reducible to a white powder, soluble in water, yielding an opalescent solution

with an acid reaction, and giving on addition of sodium carbonate a white flocculent precipitate. On an average 8.47 grams of phytin were obtained from 100 grams of sifted polishings.

Twelve fowls were fed on polished rice and each received daily 0.75 gram of phytin. Cases of polyneuritis occurred.

In the next experiment with 12 fowls on polished rice each received daily 1 gram of phytin and cases of polyneuritis occurred.

In both experiments each fowl received an amount of phytin in excess of that present in a daily ration of unpolished rice. The phosphorus content of their diet was therefore greater than that of a diet of unpolished rice.

Of the phosphorus contained in polishings 77.7 per cent is removed by the acidulated water. Of this amount 71.7 is removed in the phytin, so that with the 22.2 per cent remaining in the exhausted polishings 93.9 per cent of the phosphorus contained in polishings has been shown to be unimportant.

As shown subsequently the alcoholic filtrate from which the phytin had been removed, freed from alcohol, was effective in protecting fowls on unpolished rice from the occurrence of polyneuritis. The importance of phytin has therefore been disproved.

As the precipitate (phytin) had been shown to be ineffective, on theoretical grounds it was assumed that the whole of the active substances were contained in the filtrate.

The fraction remaining in solution after the precipitation of phytin was tested by the following procedure:

The alcoholic filtrate was nearly neutralized with sodium carbonate and evaporated at a low temperature until free from alcohol.

Each of 18 fowls on white polished rice received daily an amount of the residue equivalent to that obtained from 5 grams of polishings and all remained healthy.

That fraction of the substances originally soluble in 0.3 per cent HCl, which still remains in solution on the addition of alcohol (the acid soluble, alcohol soluble part), has thus been shown to contain the whole of the substances physiologically active, and an attempt was made to divide this fraction by alkalinizing.

An experiment carried out with the alkaline precipitate (acid soluble, alcohol soluble, alkali precipitable part), and another experiment with the alkaline filtrate (the acid soluble, alcohol soluble, alkali soluble part), had the unexpected result that the substances sought for were found to be no longer physiologically active in either fraction.

EXPERIMENT WITH THE PROOF-SPIRIT FILTRATE.

Following on the demonstration that the effective substances sought for were contained in the filtrate and therefore soluble in alcohol of proof-spirit strength, experiments were undertaken with

a view to isolating and testing the value of the various substances contained in that solution.

The solution was found to contain substances giving the reactions characteristic of proteins. On increasing the alcoholic strength of this liquid a precipitate was produced and it was hoped that by sufficiently increasing the amount of alcohol the protein would be precipitated.

The proof-spirit filtrate was nearly neutralized with sodium carbonate and freed from alcohol by evaporation at a low temperature. To the alcohol-free liquid seven times its volume of 95 per cent alcohol was added. The mixture contained 83 per cent of alcohol. It was stirred, allowed to stand for two days, and then filtered.

The precipitate obtained from the proof-spirit filtrate from 100 grams of polishings weighed on an average 2.3 grams, and consisted partly of phytin.

Each of six fowls on polished rice received daily an amount of this precipitate corresponding to that obtained from 5 grams of polishings; cases of polyneuritis occurred.

Each of six fowls on polished rice received the filtrate which had been freed from alcohol in quantities corresponding to that obtained from 5 grams of polishings; cases of polyneuritis did not occur.

A further experiment in which the mixture was allowed to stand for 10 days before filtration gave similar results.

It was thus proved that the protective substances were soluble in 83 per cent alcohol and were not inactivated by contact with alcohol of this strength for a period of 10 days.

In order that the strength of the alcoholic mixture might be considerably increased and the volume of the mixture kept within working limits absolute alcohol in place of 95 per cent alcohol was employed in the next series of experiments.

The alcohol-free liquid prepared as before from the proof-spirit filtrate was treated with 12 times its volume of absolute alcohol. The mixture contained 91 per cent of alcohol. With the precipitate obtained fowls were not protected from polyneuritis but with the filtrate they were protected. The physiologically important substances are therefore soluble in 91 per cent alcohol.

The 91 per cent alcoholic solution contains 4 per cent of the phosphorus present in the polishings. In a protective dose of the solution there is contained 0.0082 gram of phosphorus, an amount which does not appreciably increase the phosphorus content of a diet of polished rice.

EXPERIMENTS WITH 91 PER CENT ALCOHOL FILTRATE.

Experiments were undertaken with a view to the isolation and testing of the various substances contained in the 91 per cent alcoholic filtrate.

This filtrate was a clear yellowish liquid. In view of the fact that the protective substance or substances are destroyed by exposure to steam under pressure, it was considered probable that the activity of the liquid was not due to the presence of salts, but rather to the presence of some organic compound or compounds.

When the filtrate is freed from alcohol and the residue mixed with distilled water a yellowish turbid liquid is obtained. This liquid, on saturation with ammonium sulphate, yields a reddish-brown precipitate which gives the usual reactions for proteins. Half saturation with ammonium sulphate produces a slight precipitate. Saturation with sodium chloride produces a precipitate and on filtration the filtrate saturated with ammonium sulphate gives a further precipitate.

As many vegetable globulins are not precipitated until their solutions are nearly saturated with ammonium sulphate it can not be inferred that the alcoholic filtrate contains both globulin and albumin.

The filtrate freed from alcohol was found to contain glucose.

The 91 per cent alcoholic filtrate evaporated to dryness and the residue dried in a desiccator was found to contain (after making allowance for the sodium chloride formed on partial neutralization with normal solution of sodium carbonate) total solids amounting to 14.2 per cent of the sifted polishings. These solids form a brown, sticky, hygroscopic residue.

Gravimetrically it was determined that 2.9 grams of glucose, and by the Kjeldahl process that 2.08 grams of protein are contained in this 14.2 grams of total solids. The remaining 9.22 grams were assumed to be salts.

It was sought to isolate and test the value of the alcohol-soluble proteins. For this purpose dialysis was tried, but the conditions in this climate are unsuitable for dialysis, as, even with the addition of thymol, a mass of molds and bacteria develop in a day or two, both in the dialyser and the water. Unfortunately we had not a porcelain filter suitable for attachment to the water supply and eventually dialysis for the purpose of separating the alcohol-soluble proteins had to be abandoned.

It was decided to employ ammonium sulphate for the separation of these bodies.

The 91 per cent alcoholic filtrate was evaporated at 60° C. till free from alcohol. The residue was mixed with distilled water and saturated with ammonium sulphate.

The precipitate was collected and dissolved in distilled water.

Each of six fowls on polished rice received daily an amount of the precipitate equivalent to that obtained from 5 grams of polishings. A case of polyneuritis occurred.

It was considered possible that an inadequate dose of the precipitate had been given and in the next experiment twice the amount was given daily, but the results were unsatisfactory. The yellowish solution of the precipitate was a solution of the alcohol-soluble proteins in a dilute solution of ammonium sulphate. The fact that the proteins were soluble in this solution suggests that they were unchanged.

Based on this assumption, it must be concluded that the alcohol-soluble proteins are not by themselves sufficient to protect fowls fed on polished rice from the occurrence of polyneuritis.

The ammonium sulphate filtrate was, of course, useless for feeding experiments.

In previous experiments it has been shown that the protective substances are extracted from parboiled rice by the use of hot 94 per cent alcohol. It was thought possible that, as polishings are in a much finer state of subdivision, agistation with 95 per cent alcohol might suffice to extract the protective substances and not the protein, but even by this process both protein and glucose were extracted; a similar result was obtained with absolute alcohol.

It may be that the 91 per cent alcoholic filtrate contains substances other than proteins, glucose, and salts, but until such time as the various constituents of that filtrate have been isolated, tested, and identified, the biological reaction remains the only method by which the presence of the protective substances can be detected.

CONCLUSIONS.

1. From the results obtained by these researches it may be concluded that the occurrence of beriberi in the Malay Peninsula has an intimate relationship with the consumption of a diet of which white polished rice forms the staple. Those who consume unpolished rice or slightly polished (native or Malay, or parboiled) rice do not suffer from the disease.

2. Fowls fed on white polished rice known to have been associated with outbreaks of human beriberi develop a form of polyneuritis clearly analagous to beriberi in its clinical manifestations and pathological effects. Other white polished rices produce a similar result. Fowls fed on unpolished rice remain healthy.

These animals may therefore be employed to study the mode of operation by which a diet of white polished rice results in beriberi in man.

3. The estimation in terms of phosphorus pentoxide of the total phosphorus content of a given rice may be used as an indicator of the extent to which such a rice has been milled or polished and therefore of its beriberi-producing power when forming the staple of a diet in man.

4. The harmful influence of white polished rice is not due to the existence in it of a poison developed after milling. White polished rice makes default in respect of some substance of high physiological importance essential for the maintenance of health.

5. Fowls fed on white polished rice constantly develop polyneuritis in a period of three to four weeks.

6. If the polishings removed from such white rice in the process of milling be added to a diet of white polished rice, fowls remain healthy.

Substances essential for the maintenance of health are therefore contained in polishings.

7. Unpolished rice which has been submitted to sterilization in the autoclave at a temperature of 120° C. for one hour will cause polyneuritis when fed to fowls. The protective substances are destroyed under these conditions.

Methods of analysis involving exposure to high temperatures are therefore unsuitable for determining the nature of the protective substances.

8. The fats contained in the peripheral layers of the grain are of no value in protecting against polyneuritis.

9. The protective substances are soluble in 0.3 per cent hydrochloric acid.

Phytin which comprises 32.5 per cent of the substances so soluble is without value as a protective.

10. The substances are not precipitated from solution in 0.3 per cent hydrochloric acid on the addition of 95 per cent alcohol in such quantity as to make the resulting mixture of proof-spirit strength.

They are soluble in proof spirit containing approximately 0.12 per cent hydrochloric acid.

11. The protective substances are soluble in a slightly acidulated solution containing 91 per cent of alcohol and, exclusive of glucose, amount to not more than 11.3 per cent by weight of rice polishings and not more than 1.13 per cent of the original unpolished rice grain. In this fraction are included prolamine (alcohol soluble protein) and compounds of calcium, magnesium, and phosphorus.

THE PREVENTION OF BERIBERI.

By an unbroken sequence of observations and experiments beginning with rices associated with outbreaks of human beriberi, it has been demonstrated that rice is rendered harmful by the milling and polishing process to which it is subjected in the preparation of polished rice. In this process there is removed from the grain some substance of high physiological importance, the absence of which results in the production of polyneuritis in fowls and of beriberi in man when a diet is consumed of which polished rice is the staple.

Whether this substance acts by rendering other elements in the diet available for nutrition or whether it is itself the nutritive material necessary for nerve tissues can in our present state of knowledge only be matter for conjecture.

But the isolation and identification of this substance is a matter of scientific rather than of immediate practical importance to those of us who are concerned with the prevention of beriberi, though we are well aware that results may eventually be obtained of much wider significance and importance than can at present be appreciated.

The work of other observers has confirmed the accuracy of our researches, and with our present knowledge we are in a position to deal with the question of preventive measures.

Harmless and harmful rices can readily be distinguished by simple inspection, but the definition of unpolished and polished rices on the basis of histological differences alone would not suffice for practical purposes, and it is necessary to have in addition a chemical standard.

The various constituents of the rice grain are not distributed uniformly throughout the cells, and it is for this reason that certain of these substances are available for the purpose of a standard or as an indicator of the extent to which the grain has been polished.

The greater part of the fat is contained in the cells of the subpericarpal layers. Salts and protein are also relatively more abundant in the cells of these layers than in the cells of the central portion of the grain. It is obvious, therefore, that the estimation of any one of these substances would answer the purpose; the one selected must be suited to rapid and accurate estimation, and there must be such a difference in the amount contained in the two kinds of rice as to allow for a reasonable margin of error.

The extraction of fat from rice is a tedious and troublesome process. The difference in the amount of protein contained in unpolished and polished rices is not sufficiently great to allow of a good margin for experimental error, and the ordinary process of protein estimation is not really an estimation of that substance, but of the nitrogenous constituents of the grain which are capable of being converted into ammonia by a process of reduction.

The estimation of one or other of the inorganic constituents is to be preferred on account of the relative ease and accuracy with which the determination can be carried out. We originally employed the phosphorus content for this purpose, and in all our subsequent experiments and observations have found it in every way satisfactory as an indicator of the extent to which rice has been polished. A safe or harmless rice—that is, one from which not more than the pericarp or skin has been removed in the process of polishing—will invariably yield more than 0.4 per cent of phosphorus pentoxide, while a dan-

gerous or harmful rice—that is, one from which the subpericarpal layers have been removed—will yield considerably less than 0.4 per cent.

The standard of 0.4 per cent of phosphorus pentoxide is, therefore, not a high one, and the results of its application in practice could not operate unfairly upon anyone. Legislation on the subject of rice in its relationship to beriberi prevention would of necessity demand the incorporation in the enactment of a standard such as this. As already stated, no great degree of skill or training is required to distinguish polished from unpolished rice by simple inspection, but differences of opinion on this point would inevitably occur, and, when referred to a court of law, the decision would rest on the results of the chemical examination just as in the case of other foodstuffs such as milk.

The standard of 0.4 per cent of phosphorus pentoxide was fixed on the undried material; the percentage of moisture does not vary greatly among different rices, and no apparent advantage would be gained by requiring that the calculation should be based on the dried material.

Drs. Chamberlain and Vedder have recently advocated the estimation of potassium as suitable for standardization purposes. We have had no practical experience of that estimation, but there is no reason why it should not serve the purpose of an indicator quite as well as phosphorus pentoxide, save for the disadvantage which would arise from a lack of uniformity in the standard or indicator employed.

In recommending the adoption of phosphorus estimations for purposes of standardization, it should be clearly understood that we do not thereby subscribe to the view that a deficiency of phosphorus in organic combination explains the production of beriberi by the consumption of polished rice; all the evidence obtained by us is opposed to that view.

The ravages of beriberi always have been and always will be greatest among the laboring classes, who prefer polished rice and whose financial position is subject to fluctuations brought about by economic conditions over which science and medicine have no direct control. So long as these people are in regular employment and in receipt of good wages they can afford to supplement their rice ration with other articles of diet and in this way prevent the occurrence of beriberi. But when adverse conditions prevail their dietary becomes almost wholly a rice one and soon afterwards beriberi makes its appearance among them.

The use of unpolished rice at all times by these people would prevent the disease occurring among them, but this desirable result will be achieved with difficulty because, to those who have been accustomed to the use of polished rice, unpolished rice has an objectionable appearance. The association of whiteness of foodstuffs with purity has, even in countries other than these, been attended with disadvantageous results.

The education of this class of people to the advantages to be derived from the use of unpolished rice must be a slow process, but it is a moot point whether on the whole this plan might not prove to be the most successful. Already the educated Chinese employers of labor in the Malay Peninsula have shown an active interest in the dissemination of information in regard to the matter.

Undue haste in the application of the results of scientific research to practical and actual conditions have so often in the past been attended by unsatisfactory and even disastrous results that anything in the nature of sumptuary legislation should be introduced only after grave consideration. It has been proposed to make the use of unpolished rice compulsory by legislation. With this object in view it has been suggested that the importation of polished rice should be prohibited, but despotic legislation of this kind would be dangerous, impolitic, and in certain places a serious menace to trade.

Another proposal has been to tax polished rice. Such a tax to be in any way effective would require to be a heavy one and would be most troublesome to apply.

If some form of legislation be essential, then in the conditions in which we find ourselves in the Malay Peninsula a tax upon polished rice at the point of distribution appears to offer some advantages. To accomplish this it has been proposed to license dealers in polished rice, but it is doubtful if even this method in actual practice would yield results commensurate with the trouble entailed in its application.

It is necessary to emphasize the fact that a harmless rice can be converted into a harmful one by an unsatisfactory process of cooking, and energetic action is required in order to secure the cooking of rice in ordinary pots and to do away with all apparatus in which the rice is cooked by steam under pressure.

THE CURE OF BERIBERI.

Political, commercial, and other difficulties hinder the application of preventive measures, so that even in the most favorable circumstances cases of the disease must continue to occur.

In 1911 there were admitted into the Government hospitals of the Federated Malay States 5,340 cases of beriberi. These cases are almost wholly confined to the Chinese, of whom, according to the census of 1911, there are 433,244.

No estimate is possible of the cases which did not seek treatment in Government hospitals, but the available information shows that the incidence of this preventable disease was not less than 12.3 per 1,000.

It was therefore desirable to determine if a remedial agent could be prepared from polishings. As collected in the rice mills polishings are mixed with dust and adventitious substances. The mixture does not look palatable either as a gruel or as an emulsion, and we estimate

that an adult accustomed to the use of polished rice would require not less than 1.75 ounces of polishings daily; in this form there would be involved the administration of a quantity of substances unnecessary and perhaps undesirable for a sufferer from beriberi. It appeared possible that if the active substances could be separated from the mixture and given in a readily available form an agent might be obtained which would be of value in the treatment of patients suffering from beriberi.

It by no means follows that that substance the absence of which from a diet gives rise to disease will induce recovery in sufferers from that disease, but we had noted beneficial effects produced on animals suffering from polyneuritis by the administration of extracts from polishings, and all the evidence showed that the production of beriberi in man and of polyneuritis in fowls was not to be explained by any gross nutritive defect in the ordinary sense of the term, but rather by a deficiency of some substance of whose nature and action we were ignorant.

Believing, as we do, in the clinical and pathological identity of beriberi and *Polyneuritis gallinarum*, it was decided, in the first instance, to test the value of the remedial agent on fowls suffering from polyneuritis.

Experiments previously recorded have shown that the active substance is soluble in water and in 91 per cent alcohol.

In alcoholic solution it retains its activity unimpaired for months, and the first test was carried out with an alcoholic extract prepared in the following manner:

1. Sifted polishings were packed in a percolator and the fat extracted by means of petroleum ether.

2. The extracted polishings were freed from ether by exposure to the sun.

3. One part of fat-free polishings was macerated and frequently stirred in four parts of 94 per cent alcohol acidulated with 0.3 per cent of hydrochloric acid for one week.

4. The mixture was filtered and nearly neutralized with sodium carbonate.

5. The slight precipitate formed on partial neutralization was filtered off and rejected. The filtrate was concentrated under reduced pressure (temperature, 60° C.) to a small volume.

6. A little water was added to the residue and the fat, present in small amount, removed by means of petroleum ether.

7. The fat-free fluid was concentrated nearly to dryness at a temperature not exceeding 60° C. and the residue dissolved in water and alcohol in such proportion that the final product contained 50 per cent of alcohol, and 1 cubic centimeter of the fluid represented the soluble materials extracted from 10 grams of fat-free polishings.

Cases of polyneuritis were obtained in the ordinary way by feeding fowls on polished rice and as soon as an animal showed distinct evidence of the disease it received the remedial agent; throughout the treatment the fowls were fed on the rice the consumption of which had given rise to the disease. As fowls about to develop the disease and fowls with polyneuritis are averse to the consumption of polished rice, it follows that the test was a severe one. Six cases of polyneuritis (Table 1) were treated with the extract.

TABLE 1.—*Extract with acidulated cold 94 per cent alcohol.*

No.	Description.	Weight at commencement of treatment.	First week.	Second week.	Third week.	Fourth week.	Fifth week.	Sixth week.	Remarks.
		Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	
1	Spotted cock	1,060	1,060	1,075	1,120	1,100	1,120	.....	Cured after 37 days.
2	White and black spotted cock.	970	850	.....	.....	.....	.....	.....	Died 11 days after onset of disease.
3	Red cock	940	1,025	1,035	1,067	1,080	.....	.....	Cured after 32 days.
4	White and black spotted cock.	1,365	1,470	1,480	1,470	1,460	1,450	1,565	Cured after 36 days.
5	Black and red cock.	1,145	1,205	1,215	1,200	1,190	1,180	1,200	Do.
6	White and black cock.	1,260	1,315	1,380	1,415	1,420	1,445	1,455	Cured after 40 days.

Case No. 1 received twice daily 0.5 cubic centimeter of the extract. A day or two after treatment was commenced the animal regained the power to take rice in adequate amounts and 10 days later its condition was much improved; 17 days later it was practically well again. After this the remedy was given once daily, and 37 days after the commencement of the illness the animal had perfectly recovered. It was killed and the nerves on examination showed no signs of degeneration.

Case No. 2 suffered from a severe attack of the disease, with marked retraction of the head, and was obviously very ill. It was given twice daily 0.5 cubic centimeter of the extract, but was unable to eat. This was accounted for by the severity of the attack, its inability to move, and the head retraction. A little rice was therefore pushed into the crop twice daily. Three days later the animal was sufficiently recovered to eat rice voluntarily; seven days later the animal was much better and eating well, but stood with difficulty. The following morning it was found to be very ill and apparently dying, which it did at 2 p. m. At the post-mortem nothing of note was observed, but the sciatic nerves showed abundant nerve degeneration.

Case No. 3 received twice daily 0.5 cubic centimeter of the extract for four days and subsequently 0.5 cubic centimeter once daily. Sixteen days after the onset of the illness the animal had almost recovered, and 16 days later it had completely recovered. It was then killed and an examination of the sciatic nerves showed no degeneration.

Case No. 4 received 0.5 cubic centimeter of the remedy once a day. After 36 days it had recovered completely, and 4 days later it was killed; the sciatic nerves were examined and no signs of degeneration were observed.

Case No. 5 received once daily 0.5 cubic centimeter. After 36 days' treatment it had apparently completely recovered; 4 days later it was killed and a few degenerate fibers were found in the sciatic nerves.

Case No. 6 received 0.5 cubic centimeter of the extract once daily and recovery was complete after 40 days.

The next experiment was carried out to test the prophylactic value of this extract. Eight fowls were fed on polished rice and received daily 0.5 cubic centimeter of the extract. The experiment extended over 5 weeks. The fowls were in perfect health at the conclusion of that period and their weights throughout were equally satisfactory.

As a control to this experiment 8 fowls on white rice received daily five grams of the same lot of polishings as that from which the extract had been prepared; all of the animals remained healthy.

These experiments demonstrate the value of an extract prepared from polishings as a curative and prophylactic agent.

In the next experiments more thorough exhaustion of the polishings was aimed at. For this purpose one part of fat-free polishings was mixed with four parts of acidulated 94 per cent alcohol and the mixture boiled for one hour under a reflux condenser. The mixture was then allowed to stand overnight and in the morning filtered; the filtrate was treated in the manner already described, but the final volume was adjusted so that 1 cubic centimeter represented the material dissolved out from 5 grams of fat-free polishings and contained 27 per cent by volume of alcohol. Thus while increasing the volume of the prophylactic and curative dose the amount of alcohol was not increased. The lower percentage of alcohol was sufficient for purposes of conservation.

TABLE II.—*With 94 per cent alcohol hot extraction.*

No.	Description.	Weight at commencement of treatment.	First week.	Second week.	Third week.	Fourth week.	Fifth week.	Sixth week.	Remarks.
		Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*	
1	Yellow cock.....	1,200	1,225	1,300	1,315	1,350	1,425	.....	Cured after 34 days.
2	Brown and black cock.	845	920	945	890	910	920	.....	Cured after 35 days.
3	Yellow cock.....	670	670	680	710	700	730	700	Cured after 48 days.
4	White and black cock.	840	885	880	870	870	870	.....	Cured after 31 days.
5	Black and white spotted cock.	840	885	895	915	845	780	.....	Cured after 30 days.
6	Yellow cock.....	990	980	1,025	1,005	995	1,070	1,125	Cured after 44 days.

Six cases of polyneuritis (Table II) were treated with this extract, of which each case was given 1 cubic centimeter daily. The fowls continued to receive the polished rice on which they had developed the disease.

Cases No. 1, 2, 4, and 5 were completely cured in 5 weeks; case No. 6 was cured in 44 days; case No. 3 suffered from a severe attack and was cured after 48 days' treatment.

The results are therefore quite as favorable as those obtained with the first extract. The extracts prepared by these processes contain less of the nonessential material than can be obtained by any of the other processes we have employed.

Experiments are now in progress with a view to determining if the remedy can be prepared by a less expensive process thus by employing weaker alcohols or water. But the less alcohol contained in the menstruum the more saccharine material passes into solution. Whether or not the presence of this substance is disadvantageous we have not yet been able to determine. A watery extract resembling malt extract in appearance and consistence might prove valuable both from the curative and nutritive standpoints.

For those cases of beriberi with gastric disturbances it would be desirable to employ an extract containing a minimum of nonessential substances.

By either of the methods described an effective liquid extract can be prepared of which a dessert spoonful (2 drachms) represents the material obtained from 2 ounces of fat-free polishings, the daily dose for an adult suffering from beriberi. On account of various difficulties it has not yet been possible to prepare this remedial agent on a sufficiently large scale to enable trials to be carried out on the human disease, but these will be carried out in due course.

Among the many sufferers from the disease there is in all probability a proportion in whom regeneration of the nerves is impossible, but for the others a remedy is furnished which should prove of value in their treatment.

Rapid curative effects must not be anticipated; extensively degenerated nerves require time for their regeneration; but patients placed under favorable conditions and receiving daily after food a dose of this extract will have their prospects of recovery enhanced and their period of invalidism lessened.

THE PREVENTION OF BERIBERI.

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The practitioner in the United States or Europe who has not investigated the subject can have little idea of the importance of beriberi in the Orient. A consideration of the distribution and prevalence of beriberi will show that this disease ranks in importance with malaria, cholera, and plague, and that its prevention is one of the greatest problems that tropical sanitarians face. The world is justly appalled at a disaster like that of the *Titanic* where 1,500 deaths occur at once, but, strangely enough, if those 1,500 deaths were distributed throughout the year they would excite no attention whatever. And yet the end result is exactly the same whether 1,500 preventable deaths occur in an hour or a year.

In the Philippine Islands 3,334 deaths from beriberi were reported in 1910. In Hongkong alone, with a population of 350,000, there were 566 deaths from beriberi in 1910, and it is a conservative estimate that 200,000 die annually from this cause in the whole of China. In the Malay States Braddon says that during the last 20 years 150,000 cases have been treated and 30,000 have died of beriberi in Government institutions alone. Such statistics could be extended indefinitely were time available, but all who are familiar with the situation will admit that many thousands of deaths are occurring from beriberi every year. Moreover, only about 5 per cent of the cases die, so that the total number of cases runs into the millions.

But can this suffering and mortality be prevented? We have no hesitation in affirming that beriberi is a preventable disease in the sense that we already know sufficient concerning its etiology to prevent its occurrence if we can apply that knowledge in a practical way. It will be the purpose of this paper to propose and discuss a method of applying this knowledge that is believed to be practical; but it will be advisable to state first exactly what we may be said to know regarding the cause of beriberi.

It may be stated, without fear of successful contradiction, that beriberi is directly caused by an improper dietary. A number of investigators in times past have claimed that the disease was infectious and many of them have incriminated some specific organism. But these organisms are as various as the investigators, and in no single case has the claim been substantiated. On the other hand, in recent years a mass of evidence has been obtained showing clearly that the disease is caused by an improper diet, and this evidence has never been successfully controverted. It would require a volume to present this evidence properly, but we may invite attention to the

experiments of Eijkman,[1] Grijns,[2] Schaumann,[3] Fraser and Stanton,[4] Shiga and Kusama,[5] and Chamberlain and Vedder,[6] on fowls. While these investigators differ among themselves in minor particulars, they are all agreed that *Polyneuritis gallinarum*, a disease of fowls closely resembling beriberi in man, is undoubtedly produced by an exclusive diet of overmilled or polished rice, and that this diet operates to produce the disease because of its deficiency in some substance or substances.

We must also mention Braddon's monumental work.[7] A critical reading of Braddon's book is believed to be sufficient to convince any one that beriberi is undoubtedly caused by the consumption of polished rice, although we can not agree with that author in his conclusion that the disease is a toxemia. We must recollect that Takaki[8] eradicated beriberi from the Japanese Navy by a simple change in the ration, and that the disease has been eradicated from the Philippine Scouts by simple changes in their dietary.[9] These native troops, numbering 5,000, formerly suffered from beriberi to the extent of 600 cases annually, whereas at present the disease is nonexistent. This wonderful improvement has been brought about by the addition of a legume to the ration and the substitution of undermilled for overmilled rice. The same beneficent result has been obtained in all Government institutions in the Philippines by a similar change in diet.[10]

But more important is the human experiment of Fraser and Stanton,[4] because it is absolutely conclusive. These investigators took 300 Javanese laborers occupying new and sanitary quarters in a virgin jungle. They were divided into two parties of equal numbers, after excluding the existence of beriberi by an examination of each person. One party received polished rice as the staple article of diet and the other party parboiled rice. In three months beriberi appeared in the members of the party receiving white rice. When a certain number of cases had been noted polished rice was discontinued, and thereafter no cases occurred. No sign of the disease appeared among the party receiving parboiled rice. The conditions were then reversed. The party hitherto on parboiled rice were given white rice and, after a somewhat longer interval, beriberi broke out in this group also. This outbreak ceased on discontinuing the issue of white rice. Again no sign of the disease appeared among the control party on parboiled rice. Place infection and communicability were excluded by transferring individuals suffering from beriberi from one group to the other.

Such an experiment should be conclusive, but many have thought that it should be repeated before being accepted without reservation. This has now been accomplished. Strong and Crowell, in the experiments just reported to this congress, have afforded a complete con-

firmation of Fraser and Stanton's experiment by producing beriberi in prisoners in Bilibid by feeding them a diet whose staple was overmilled or polished rice.

We are therefore now in a position to state that beriberi is caused by an improper diet, usually consisting of a too exclusive ration of overmilled rice, and from a scientific standpoint it should be a simple matter to prevent the disease. All that is necessary is to prescribe a sufficiently varied diet and to insist on the consumption of an undermilled rice. Unfortunately the problem is not so simple, because this is a recommendation which is utterly at variance with the economic and sociologic habits of entire races. It is useless to prescribe a varied diet to natives who are so poor that they are unable to obtain it. There are a few natives who live chiefly upon rice because they prefer it to other food, but in all oriental countries the majority of the inhabitants subsist upon rice because they are unable to obtain more costly food.

Therefore only one measure will prevent beriberi, and that is the general substitution of undermilled for highly milled or polished rice. This may be readily accomplished in jails, hospitals, and other governmental institutions by an executive order, but it is exceedingly difficult to induce the people as a whole to use the undermilled rice. In the first place, many of them have been accustomed for years to consider the highly milled and polished rice as the best quality, and generally purchase it by preference. In the second place, even if they wished to purchase undermilled rice, they can not do so under present conditions, because all the rice mills produce highly milled rice, and all the rice that is imported is highly milled and there is very little undermilled rice on the market. There appear to be only two methods of attacking this sanitary problem. The first method is to educate the people to demand the undermilled rice, on the supposition that when the demand for this article increases sufficiently the rice mills will change their methods of milling and will furnish the people the undermilled rice.

In accordance with this plan, which has been highly recommended, a campaign of education should be waged by the health officials, to inform the people of the danger they run in using the highly milled rice.

To me it appears that any such educational campaign is doomed to failure because of the magnitude of the undertaking and because those who propose it fail to take into consideration the inertia and disinclination of oriental peoples to change their habits. Some conception of the magnitude of the undertaking may be obtained if we imagine a similar condition in the United States or Europe. Let us suppose, for instance, that some serious disease, such as cancer, were caused by eating white bread and that it could be entirely

prevented by eating whole-wheat bread. How long would it take us to change the habits of the entire people by a campaign of education and induce them all to eat whole-wheat bread? Europeans and Americans are intelligent and are not constitutionally opposed to a change of custom, yet it must be admitted that it would require years to effect such a change, probably at least a decade. All intelligent people know that typhoid is a disease contracted directly from an antecedent case of the same disease, and yet whole cities and communities still continue to use diluted sewage for their drinking supply from streams which everyone knows are grossly contaminated. To effect such a radical change in the staple food of an oriental people by education alone would require a century, if, indeed, it could be accomplished at all. And in the meantime they would still suffer from beriberi, a disease that is clearly preventable. Such a situation is intolerable.

On the other hand is the possibility of enforcing the use of an undermilled rice by placing a tax on overmilled rice which would make the price of this latter prohibitive for the poor people. This method has been suggested and urged by Dr. Victor G. Heiser, director of health for the Philippine Islands [10]. After considerable discussion with physicians, lawyers, legislators, and others a bill was introduced in the Philippine Assembly in 1911 imposing a tax of 5 centavos (2½ cents United States currency) per kilo on all polished rice sold, whether foreign or domestic. The legislature, however, adjourned before the matter could be fully considered. The same bill was reintroduced the following year, but owing to the fact that the islands were already suffering from a serious shortage of rice, it was deemed inadvisable to pass the bill at that time.

The Far Eastern Association of Tropical Medicine met in Hongkong in January, 1912, and considered this proposition very fully. But while this association accepted the fact that beriberi is caused by a too exclusive diet of polished rice, it refused to unequivocally recommend such a tax on this rice because it believed that such action would exceed its authority and because it doubted the expediency of such a tax.[11] No decisive action has therefore been taken on this proposition in any part of the world, and meantime the prevalence of beriberi is increasing rather than diminishing, because the use of highly milled rice is becoming more extensive year by year. We may expect that this extension of the disease will continue, because as European civilization progresses in the Tropics fewer natives will pound their own rice, and more of them will take their rice to the mills, or will be employed in some industrial occupation. These latter being paid in money will purchase their rice in the open market and will obtain the highly milled rice. It will be just as impossible

to prevent this state of affairs without taking some decisive action as it would be to stop the progress of that civilization itself.

Those modern nations who have colonies in the Tropics justly take pride in the advances thay have made in sanitation, yet here is one disease, clearly preventable, which is even more prevalent than was formerly the case, simply because these Governments have not yet been aroused to action.

Let us consider the arguments for and against the solution of the difficulty by means of a tax such as has been proposed. The argument for such a tax may be briefly summed up as follows: Something must be done to meet an intolerable sanitary condition. Only two remedies have been proposed, namely, the gradual education of the people and a tax on overmilled rice, and the former remedy has already been discarded as impracticable.

The objections to such a tax are: (1) That it would be difficult to enforce; (2) that it would cause native discontent; (3) that it would derange commerce.

(1) *A tax on highly milled rice would be difficult to enforce.*—In many countries the enforcement of such a tax would be simplicity itself. In the Philippine Islands, for instance, the tax could be collected at each rice mill, by officers of the internal revenue department and would be no more difficult of collection than is the internal revenue tax on spirits. It could also be collected on all imported rice by the customs officials just as are other duties. The machinery is already in existence and all that is needed is the law.

But this is not the case with all countries. Many of them, for instance the British colonies that enjoy free trade, have not a regular customs service. Yet even these countries impose a tax on imported liquors and tobacco, and have officials to collect this tax. These same officials could also collect the tax on rice. One inspector for each of the principal ports of entry would suffice to collect this tax and this office could easily be created by the same law that imposed the tax. Moreover, it is far from certain that it would be necessary or desirable to impose an import tax. So far as I am aware, practically all nations have an internal-revenue tax on spirits.

Now, if Indo China, which is one of the chief exporters of rice, should pass a law taxing overmilled rice and should collect this tax by its officers of internal revenue, it would have the effect of increasing the cost of all the highly milled rice exported through Saigon by the amount of the tax. This highly milled rice would be increased in price when imported into a British colony under free-trade laws, even though no additional tax was imposed by that colony. The essential point is therefore that each Government should impose a tax on the overmilled rice actually produced by its own mills. The

tax on imported overmilled rice could then be ignored. The machinery for the imposition of this tax already exists in practically every civilized community and its collection would be comparatively easy.

2. Such a tax would provoke native discontent.—It must be emphasized that in order to effect its purpose the tax must be sufficiently high to make overmilled rice prohibitive in price to the poor people. If this is effected the markets will be supplied with undermilled rice, which would be no more expensive than is the present overmilled rice. Indeed it is to be hoped that the undermilled rice would be cheaper, since less time and labor are expended in milling this rice. Any discontent that would be produced by the operation of this law would therefore be due solely to the fact that the native would be compelled to subsist on undermilled rice instead of upon highly milled rice, thus effecting a mild revolution in his dietary habits.

That a certain amount of discontent might be produced in this way may be admitted, but it would be trivial in extent and only temporary in duration. That this would be the case is indicated by the experience in the Philippines in those institutions where this change has already been effected. When undermilled rice was first supplied to the Philippine scouts (native soldiers) instead of the highly milled rice to which they were accustomed, complaints were numerous. Investigation of these complaints, however, clearly showed that the rice supplied under the new contract was of a poorer quality than that formerly used and contained a large quantity of dirt, chaff, unhulled and broken grains. This difficulty was corrected, and an absolutely first-class quality of undermilled rice was supplied, and the complaints ceased. This undermilled rice has now been used by these scouts from August, 1910, until the present time and appears to give excellent satisfaction, for complaints are unknown.

On May 4, 1909, the Governor General of the Philippines issued an executive order forbidding the use of highly milled rice in any public institution. As a result of this order, undermilled rice was furnished all Government hospitals, jails, lighthouses, etc. Complaints also followed this innovation. Dr. Heiser, the director of health, says:

> It was apparent then that much of the unpolished rice that was issued in the beginning was not very clean and contained many husks. This gave rise to much complaint among those who were required to use it. It was frequently alleged that the husks tickled the throats and often caused gastritis. On investigation no reliable evidence as to the gastritis could be obtained. Commissary officers, prison wardens, and others who were directly charged with carrying out the orders to use unpolished rice, were constantly besieged with complaints, and it was but natural that they should take the course of least resistance and recommend that its use be discontinued. To add to the difficulties of those who were insisting on the use of unpolished rice, the rumor spread that unpolished rice when stored in bulk soon spoiled, thus causing great financial loss. Investigation of this matter showed that there was no reason to believe that unpolished rice, when stored under the same conditions as polished rice, spoiled more quickly.

Efforts were then made to obtain an undermilled rice clean and free from husks. Such a rice has since been continuously furnished to governmental institutions, and all complaints by those consuming it have ceased, although at various times officials still claim that it is difficult to obtain such a rice. In short, it appears quite evident that such complaint as there has been has arisen, not because the use of undermilled rice was ordered, but because it was of a poor quality.

Objection on the part of the native to undermilled rice is practically certain to be but temporary, because an undermilled rice is a better rice. It has a rich nutty flavor that is lacking in overmilled rice and has a higher food value. My patients for whom I have procured undermilled rice are unanimous in asserting that they prefer it and would always buy that kind if they could find it on the market.

3. *A tax on highly milled rice would derange commerce.*—This is the most serious objection to be met, since we are dealing with a staple article which is the very existence of many countries. It is believed that such a tax could be imposed in a country like the Philippines, which imports rice, without deranging its commerce except possibly during the years when there is a general shortage of rice throughout the Orient. The case is, however, far different in countries, like Indo-China, which are large exporters of rice. The officials of such a country naturally fear that if they should impose a tax on overmilled rice they would lose this trade, which would be gained by some country which imposed no tax or a smaller tax. It is exceedingly probable that this is exactly what would follow such an action, and therefore it is apparent that a single nation will hesitate before taking such an economic risk. What then remains? Plainly the only solution consists in an international action by which all rice-producing countries will impose this tax on highly milled rice at the same time. If such international action were taken, it is certain that commerce would not be deranged, and while it is difficult to secure such action it is by no means impossible. The opium congress which has just been held at The Hague has shown that it is possible to secure international action on a sanitary problem. There are many details connected with the passage of an international tax on overmilled rice. These include the effect of such an action on the millers of rice, the amount of the tax necessary to effect the purpose desired, the adoption of a suitable standard for overmilled and undermilled rice, the necessity for giving due warning of such action, the necessity of making provision to exempt from the tax rice that is exported to Europe and the United States where beriberi is not endemic, and many other subjects. Unfortunately these details can not be discussed for lack of time, and for the same reason

the entire subject is most briefly presented. To recapitulate, however, we have shown that beriberi is most prevalent in the Orient and that it is caused by an improper dietary, usually one consisting chiefly of overmilled rice; that it can therefore be prevented if the use of undermilled rice can be made universal. It has been suggested that this result can be effected by a tax on overmilled rice, but that such action must be international.

We are therefore brought to our conclusion, which is an appeal to this International Congress on Hygiene that it will appoint a committee to investigate this most important subject and report on the advisability and practicability of such international action. Some action must manifestly be taken in the near future to limit this preventable disease. It can not be taken at a more fitting time or place than the present international congress, and the adoption of a remedy for the eradication of this preventable disease will cause this meeting to be remembered as a landmark in the history of preventive medicine.

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[1] Polyneuritis bij hoenderen. Geneesk. Tijdschr. v. Ned. Ind., Vol. XXX, 1890. Archiv. f. Hyg., Vol., LVIII, 1906. Virchows Archiv., Vol. CLXVIII, 1897.

[2] Grijns. Over Polyneuritis Gallinarum. Geneesk. Tijdschr. v. Ned. Ind., Vol. XLI, Vol. XLIX.

[3] Schaumann. Die Aetiologie der Beriberi unter Beruck-sichtigung des gesamten Phosphorstoffwechsels. Archiv. f. Schiffs und Tropen Hygiene, Vol. XIV, December, 1910.

[4] Fraser and Stanton. The Etiology of Beriberi. Studies from the Institute for Medical Research, Federated Malay States, No. 12, 1911.

[5] Shiga and Kusama. Uber die Kakke-ahnliche Krankheit der Tiere. Archiv. f. Schiffs und Tropen Hygiene, Vol. XV, No. 3, May, 1911.

[6] Chamberlain and Vedder. A contribution to the Etiology of Beriberi. Phil. Jour. of Science, Vol. VI, No. 3, June, 1911. A Second Contribution to the Etiology of Beriberi. Phil. Jour. of Science, Vol. VI, No. 5, November, 1911. A Third Contribution to the Etiology of Beriberi, Phil. Jour. of Science, Vol. VII, No. 1, 1912.

[7] Braddon. The Cause and Prevention of Beriberi. London, 1907.

[8] Takaki. Three Lectures on the Preservation of Health amongst the Personnel of the Japanese Navy and Army. Lancet, 1906. pp. 1369, 1451, 1520.

[9] Chamberlain. The Eradication of Beriberi from the Philippine Scouts by means of a Simple Change in their Dietary. Phil. Jour. of Science, Vol. VI, No. 2, April, 1911.

[10] Heiser. Practical Experiences with Beriberi and Unpolished Rice. Phil. Jour. of Science, Vol. VI, No. 3, June, 1911, also Journal American Medical Association, April 29, 1911. Beriberi, Governmental aid in its Eradication. Medical Record, March 16, 1912.

[11] See resolution passed by the Far Eastern Association of Tropical Medicine. Medical Record, Vol. 81, No. 13, March 30, 1912. p. 630.

THE ETIOLOGY OF BERIBERI.

RICHARD P. STRONG and B. C. CROWELL.

The etiology of beriberi is a problem about which there has been very extensive and prolonged controversy. The theories advanced in regard to the cause of the disease have been numerous and of a widely different character. Many of them have been based upon little or no accurate experimental investigation. Notwithstanding the large number of very valuable observations that have been reported in the literature on this subject during the past few years, at the present time there is no theory of the cause of beriberi that has been entirely accepted. The reason for this becomes more apparent when we consider the recent publications upon the subject. While very extensive feeding experiments by numerous investigators have been performed upon fowls, regarding the production of *Polyneuritis gallinarum* (Eijkman), and while a few similar experiments have been employed, even sometimes successfully, by several investigators in relation to the production of a beriberilike disease in other animals, nevertheless there has been, regarding the etiology of beriberi, not a single experiment upon man which, from a scientific standpoint, we can regard in any way as a crucial test of the infectious or noninfectious nature of the disease, with the exception of that one performed by Fraser and Stanton [1] in 1909. At the close of their publication regarding this experiment, these authors state:

The general results (of these experiments) lend support to the view that the disease beriberi, as it occurs in this peninsula has, if not its origin in, at least an intimate relationship with, the consumption of white rice, and justify further research along these lines.

We have referred to the fact that the theories regarding the etiology of beriberi have been numerous. However, it is not our intention to consider them in detail here. They have been discussed in numerous textbooks, and among other authors, particularly by Herzog of this laboratory, in 1902,[2] and more recently by Castellani [3] and by Schaumann.[4] However, we wish to consider briefly the question of whether beriberi is an infectious disease, owing its origin to some living specific microorganism, either bacterial or protozoal or its toxin, and conveyed directly or indirectly from man to man, or whether it is one due to disturbances in metabolism caused by an abnormal diet. Among those who have had a wide experience with beriberi and who have favored the theory that the disease is an infectious one, and not one due to deficient or scanty nutrition may be mentioned Manson,[5] Scheube,[6] Bälz,[7] Jeanselme,[8] le Dantec,[9] Marchoux,[10] Daniels,[11] Wright,[12] Castellani,[13] and Shibayama,[14] and the arguments which some of these writers deduce against the theory

of a dietetic causation are very convincing. Castellani,[15] writing in 1910, after a consideration of Fraser and Stanton's experiments, states:

To summarize from the evidence, it appears more likely that a parasite will be found to be the spreader of the disease, which makes it more probable that the actual cause will be found to be a protozoon than that it is due to diet, which, however, may be a predisposing cause, especially if the nutritive value of the food is low, or the proportions wrong. Shibayama[16] also holds a somewhat similar view: It is therefore not unreasonable to assume that the microorganisms of beriberi are only present in the Orient and, given a predisposing cause, are capable of causing the disease, whereas in the West beriberi does not appear, owing to the absence of the infecting organisms, although the same favorable predisposing cause may be present.

While Marchoux[16] (also writing in 1910) believes that a diet of white rice furnishes in the intestine a favorable culture medium for the development of the specific organism of beriberi and that the addition of rice bran to the diet without doubt renders the condition in the intestine unfavorable for the development of this organism.

However, none of these authors has brought forward any definite proof that beriberi is caused by a specific microorganism and, although numerous other investigators have described either various species of bacteria or of protozoa as the cause of the disease, yet to-day not one of these claims has been substantiated from a scientific standpoint. Obviously, however, the fact that the specific microorganism for the disease has not been discovered is not a final argument against its infectious nature, for the causative organism in many diseases of an undoubted infectious nature has been sought for as diligently and in a manner equally as unsuccessful as in the case of beriberi. The result of the experiments of de Haan and Grijns[17] failing to demonstrate the presence of antibodies in the blood serum or various organs of beriberi patients or of fowls suffering with polyneuritis, as well as that of the experiments of Shiga and Kusama[18] who failed to obtain the reaction of deflection of the complement in the serum of beriberi cases, also does not exclude definitely the possibility of the disease being an infectious one.

However, if by scientifically controlled and accurate experiments we can produce the disease and exclude the influence of a living specific microorganism, the infectious theory of its origin can be regarded as tenable no longer. Recently, few investigators[19] have pursued researches relating to a search for a specific organism for beriberi, but on the other hand the theory that the disease owes its origin to disturbances in nutrition has been widely discussed. However, as mentioned, the great majority of these recent publications

relate to experiments upon the production of *Polyneuritis gallinarum* and not to the production of beriberi in man.

In regard to the relation of *Polyneuritis gallinarum* to beriberi, it seems advisable to consider the views of a number of investigators upon this subject. Shibayama [20] cautions against regarding polyneuritis of fowls as being identical with human beriberi, and Eijkman [21] states: Regarding the question of the relationship between *Polyneuritis gallinarum* and beriberi, I have always expressed myself very reservedly. I have not claimed their identity in an etiological sense, but I also could not absolutely deny this, and am of the same opinion at the present time. In my first publication (1889) I have mentioned, besides the many points of agreement in the two, also some points of difference. Schaumann [22] believes: Not that both diseases are identical, but that there seem to exist many more reasons for assuming that both are intimately related to each other than to presume the contrary, chiefly by taking into consideration that the same cause may not necessarily have the same results in different organisms.

Shiga and Kusama [23] state it would be too much to say that the polyneuritis of animals and beriberi are identical without further proof. Many prominent authorities, both clinicians and pathologists, are of the opinion that in the diagnosis of human beriberi two chief symptoms—namely, the sensory and motor paralyses of the lower legs and the dilatation and hypertrophy of the heart—must be considered.[24] Fraser, in December, 1911,[25] states: On account of the prominence given the experiments on animals it is possible to lose sight of the fact that we, as medical men, are concerned with the etiology of a disease which affects men and is known as beriberi. Experiments on fowls have proved to be of an inestimable value in working out the etiology of beriberi. The reaction in fowls is quite as delicate as and comparable with a reaction in vitro; but there is no necessity whatsoever to argue for or against the identity of polyneuritis in fowls and beriberi in man.

On the other hand, Chamberlain and Vedder [26] and Tzuzki [27] believe that *Polyneuritis gallinarum* and beriberi are essentially the same disease. Obviously, however, this latter view seemed hardly justifiable until confirmed by further experiments on human beings.

We believe that while experiments on fowls have been of very great benefit in elucidating many problems relating to the etiology and cure of beriberi, nevertheless, without similar experiments or observations on man, the results obtained with the former would not be applicable to man. The experiments on fowls have certainly in some instances furnished a justification for adopting a similar method of procedure in man in relation to the study and cure of beriberi, and in this respect therein perhaps lies their greatest value. The

results of the experiments on other animals, including monkeys (Eijkman,[28] Fraser and Stanton,[29] Schaumann,[30] Aron, [31] Shiga and Kusama,[32] Wright,[33] Durham,[34] and others), have been hitherto too uncertain to warrant our drawing definite conclusions from them in relation to beriberi in man. Monkeys, as well as fowls, sometimes suffer with polyneuritis from various causes.

Therefore, before we could arrive at a definite decision as to the infectious or noninfectious nature of the disease beriberi, further observations upon man in relation to this question seemed necessary.

In the year 1910, a short time after our experiments were commenced, the etiology of beriberi was still to such an extent an open question that the Société de Pathologie exotique, through its president, M. Roux, director of the Pasteur Institute, appointed a committee [35] to investigate the subject and to collect information in the countries where beriberi existed.

The object of our study was to determine definitely, if possible, whether beriberi, as it occurs in the Philippine Islands, is an infectious disease or whether it is one which has its origin in disturbances in metabolism, brought about by the prolonged use of polished rice as a staple article of diet. The experiments were carried out in Bilibid prison, in Manila, in which institution the hygienic conditions may be said to be almost ideal.

Twenty-nine prisoners, all under sentence of death, volunteered to undergo the experiment. They were divided into four groups. Three of the groups were then placed in a bartolina or small inner prison, on one side of the main prison yard, and the fourth group in another bartolina, situated at the other side of the prison yard. The two bartolinas were entirely separated from one another by high walls. Each bartolina contained a cell house, comprising five rooms or cells.

Each group of the subjects of the experiments was assigned to one of these rooms of the cell house and were locked up in it at night. In the morning each prison cell was unlocked, and during the day all the subjects of the experiments in one bartolina were allowed to mingle freely with one another, except at meal times. During the meal time the different groups ate in separate rooms under the observation of one of us or occasionally under the observation of the American guard, so that it was quite impossible for any interchange of food between the different groups to occur. The food used was weighed for each meal and cooked outside of the prison in a special kitchen, by a special cook, in a cleanly manner and under very careful supervision. After cooking it was divided into equal parts according to the number to be fed. Each man's food was put into a special dinner pail marked with his number and so served to him.

At the close of the meal each man turned in his pail containing the amount of food uneaten, and a record of the amount was entered in the notes. None of the prisoners was allowed to retain any of the uneaten food. The rice was served hot. It was of course always freshly cooked for each meal, as were all the articles of the diet. The conditions of the isolation of the men, as is obvious, were such as to preclude the possibility of any other food reaching them in any way or at any time. Groups I, II, and III were confined in bartolina A and group IV in bartolina B. The meals served were as follows:

TABLE I.—*Diets employed.*

	Article.	Quantity.
		Grams.
Breakfast	Bread	100
	Coffee	[1] 500
	Sugar	15
Dinner:		
Group I	Rice	300
	Bacon	50
Group II	Rice	300
	Onions	100
	Lard	15
Group III	Rice	300
	Bananas	100
	Sugar	25
Group IV	Rice	200
	Bread	150
	Bacon	30
Group V	Rice	100
	Bread	150
	Starch	50
	Sugar	25
	Lard	20
Supper:		
Group I	Rice	350
	Onions	150
	Lard	20
Group II	Rice	300
	Bacon	50
Group III	Rice	300
	Bananas	150
	Sugar	75
Group IV	Bread	200
	Rice	100
	Starch	50
	Sugar	25
	Lard	20

[1] Cubic centimeters.

It soon became evident that it was impossible to serve dinner No. V and supper No. IV in an acceptable form to the subjects of the experiment, and therefore these were eliminated. The other diets were alternated.

On the ninety-seventh day of the experiment with Groups I, II, and III, and on the eighty-first day with Group IV, 100 grams of potatoes and 30 grams of dried codfish were added to the diet, and these articles were served, at intervals, with 300 grams of rice in rotation with the other meals. Table II gives the percentage of phosphorus pentoxide and of the nitrogen in the articles of diet employed throughout the experiment.

TABLE II.—*Composition of foods used in the experiment.*

Kind of food.	P_2O_5	N.
	Per cent.	*Per cent.*
Bacon	0.21	0.7
Onions	.7	1.8
Codfish (dried)	2.9	10.58
White rice (la blanco)	.37	1.25
Red rice (Pinawa)	.69	1.16
Starch	Trace.	.18
Rice polishings (Darác	4.47	1.8
Sugar	Trace.	2.11
Potatoes	.23	.31
Alcoholic extract of rice polishings	.025	.365

NATURE OF THE RICE EMPLOYED.

All the subjects of the experiment received exactly the same diet except in regard to the kind of rice. As the experiment was originally planned it was proposed to feed three groups, as follows:

I. White rice + rice polishings.

II. White rice + alcoholic extract of rice polishings.

III. White rice alone.

However, after a few days it was found impossible to persuade any of the individuals to eat further the rice mixed with the polishings or to prepare the polishings so that they would be eaten. Although they were not informed what they were being served to eat, they detected at once that the polishings were mixed with the rice. They were persuaded to eat some of it for a few days; then they persistently refused to partake of it, even though they began to suffer from marked hunger, insisting that it caused gastric disturbances and soreness in the pharynx. The polishings were, of course, uncooked and were mixed with the rice after it was cooked in order that there might be no opportunity for the criticism that the protective substances in the polishings had been destroyed by heat. As there was no object in continuing the experiment if the members of this group (No. 1) did not eat the rice, we placed them upon red (pinawa) rice.[36]

The white polished rice employed throughout our experiments was specially milled and polished for us by Messrs. Smith, Bell & Co., of Manila, at their new mills, and the samples contained 0.37 per cent of phosphorus pentoxide. The rice polishings employed at first mixed with the rice and also for the purpose of making the alcoholic extract that was used throughout the experiment were also especially prepared by this firm and were free from grain weevils. The commercial polishings for sale in the markets always contain weevils in great abundance, and it is very difficult or impossible to separate them from the polishings.

PREPARATION OF THE EXTRACT OFRICE POLISHINGS EMPLOYED.

The extract of the polishings was prepared by Mr. Hocson, of the physiological laboratory of the Philippine College of Medicine and

Surgery, to whom we wish to express our thanks. The extract was always freshly prepared every third day and used before any deterioration could have occurred. The method of preparation employed, which was essentially that of Chamberlain and Vedder,[37] was as follows:

Five kilograms of rice polishings (darâc) were extracted with 14,000 cubic centimeters of 95 per cent alcohol by three successive macerations of 24 hours each, using for the first day 6,000 cubic centimeters and for the second and third 4,000 cubic centimeters. After each day of maceration the liquid was strained, pressed, filtered, and the filtrate transferred to a porcelain dish. To facilitate the evaporation of the alcohol, of which there was a large amount present, a portion of the alcohol was evaporated more rapidly by means of an electric fan and the fat separated from the extract. The extract was then concentrated to 125 cubic centimeters in vacuum at 60° C., and the residue obtained was made up in volume to 625 cubic centimeters with distilled water.

The experiments were continued for as long a period as was practicable. When a prisoner insisted upon being returned to the regular prison ration or his condition became such that a change of diet seemed advisable the experiment was discontinued. All of the prisoners were healthy at the time of the beginning of the experiment and had been under observation for some weeks. None of them gave a history of having suffered with beriberi previously.

TABLE III.—*Showing nature of the rice received by the different groups.*

Cases.	Kind of rice and days served.	Period under treatment.
	GROUP I.	
No. 4	White rice+rice polishings for 13 days, followed by white rice+extract of rice polishings for 84 days.	97 days.
Nos. 1, 2, 3, 5, and 6	White rice+rice polishings for 13 days, followed by white rice+extract of rice polishings for 95 days.	108 days.
	GROUP II.	
Nos. 7 and 8	White rice for 97 days, followed by red rice for 20 days	117 days.
Nos. 9 and 11	White rice for 97 days	
Nos. 10 and 12	White rice for 108 days	
	GROUP III.	
No. 14	White rice+rice polishings for 17 days, followed by red rice for 80 days.	97 days.
Nos. 13, 15, 16, 17, and 18	White rice+rice polishings for 17 days, followed by red rice for 100 days.	117 days.
	GROUP IV.	
Nos. 25 and 26	White rice for 81 days	101 days.[a]
Nos. 19, 20, 21, 22, 23, and 24	White rice for 92 days	
Nos. 27 and 28	White rice for 82 days	
No. 29	White rice for 75 days	

[a] For about the first 13 days Group I were fed white rice mixed with the rice polishings, as we had not sufficient extract on hand to begin the experiment with this group; and Group III for the first 17 days were fed white rice mixed with rice polishings, red rice being then substituted for the reason already stated, that the prisoners could not eat the rice polishings.

SUMMARY OF THE RESULTS OF THE EXPERIMENTS.

If we now compare the results of the experiments in the different groups, it may be seen from the tables that in Group I, where the diet consisted largely of white rice together with extract of rice polishings, four of the six individuals comprising the group developed no symptoms of beriberi during the time of the experiment. One, No. 1, developed rather marked early symptoms of beriberi, and one, No. 3, developed some of the early symptoms of this disease. The symptoms of these cases did not improve until the monotony of the diet was varied by the addition of dried codfish and potatoes. Nos. 4 and 6 of this group suffered merely from erosions about the corners of the mouth during the experiment. It seems advisable to consider briefly the symptoms in the cases which suggested the diagnosis of beriberi. In case No. 1 the loss of weight was constant throughout the course of the experiment until the diet was changed, the individual losing in all 17.5 pounds in weight. From the time that fish and potatoes were added to the diet he began to gain slightly in weight and the unfavorable symptoms to improve. The striking symptoms suggestive of beriberi in this case were the slight increase of knee jerks noticed first on the eighty-first day of the experiment, pain in the abdomen, the huskiness and almost complete loss of the voice, the development of tachycardia, epigastric pulsation, slight edema of the legs, and tenderness of the calves. These symptoms certainly were suggestive of beriberi. While it is an acknowledged fact that all cases of beriberi do not show loss of knee jerks, and that usually, if perhaps not always, this symptom is a late one in the course of the disease; nevertheless in an exepriment of this nature a definite diagnosis of beriberi was not made unless the loss of knee jerks had occurred in conjunction with the appearance of other symptoms of this disease. It obviously is also impossible to state whether, had the diet been continued for a longer period of time in this individual, more definite symptoms of beriberi would have developed, but his condition and the progression of the symptoms certainly suggested such a course. In any case, a condition simulating beriberi was produced in this individual. In case No. 3 the patient lost almost continuously in weight up to the eighty-fourth day of the experiment, 10 pounds in all. The only symptoms of beriberi which were noted were development of abdominal pain, visible epigastric pulsation, pain and tenderness in the calves of the legs, and huskiness of the voice. These symptoms improved upon the addition of dried codfish and potatoes to the diet, but the patient did not gain in weight until placed upon the regular prison ration. The dried codfish, as may be seen from Table II, contained 2.9 per cent phosphorus

pentoxide, but the potatoes only 0.25 per cent, which is less than the amount present in the white polished rice (0.37 per cent) employed in the experiments. The loss of weight in the subjects comprising this group, during the experiment, may be seen from the table of Group I.

GROUP I.—*Fed white polished rice + Alcoholic extract of rice polishings.*

Case No. 1[a]	Lost 17. 5 pounds.
Case No. 2	Lost 6. 5 pounds.
Case No. 3[a]	Lost 10 pounds.
Case No. 4	Lost 4. 5 pounds.
Case No. 5	Lost 4. 5 pounds, then gained 6. 5 pounds.
Case No. 6	Lost 9. 5 pounds.

In none of the other cases of this group was the loss of weight so marked as in case No. 1, though case No. 6, in which no symptoms of beriberi developed, lost practically as much (9.5 pounds) as did case No. 3.

In Groups II and IV, the diet consisted largely of white rice. In Group II, 4 of the 6 individuals comprising the experiment developed beriberi (Nos. 8, 9, 10, 11), and 2 (Nos. 7 and 12) developed early symptoms of the disease, while in Group IV, 4 of the 11 (Nos. 20, 26, 25, 29) developed beriberi, 2 (Nos. 19 and 22) developed early symptoms of the disease, 1 (No. 21) doubtful symptoms, and 4 (Nos. 23, 24, 27, 28) showed no symptoms of beriberi throughout the experiment.

It is also advisable to examine into the symptoms of beriberi which developed in the individuals comprising these groups. In case No. 8 of Group II the most striking symptoms were the edema of the legs and tenderness of the calf muscles, loss of knee jerks, and change in the position of the apex beat of the heart. In case No. 9 epigastric pain and pulsation, marked dyspnea, paresthesia and hypesthesia of areas of the skin, and hyperesthesia of the muscles of the calves, together with loss of knee jerks. In case No. 10 the prominent symptoms were cardiac disturbances, hyperesthesia of the calf muscles, and loss of knee jerks, while in No. 11 paresthesia, hyperesthesia of the calf muscles, cardiac disturbances, loss of knee jerks, and development of foot drop occurred. In No. 7 the most striking symptoms suggesting the development of beriberi were anesthesia and paresthesia of areas of the skin, hyperesthesia of the calf muscles, and cardiac disturbances. The knee jerks were absent before the experiment commenced and remained so. In No. 12 cardiac disturbances, pain and tenderness of the calf muscles, and edema of the legs occurred.

[a] Developed symptoms of beriberi.

The loss of weight in the subjects comprising this group during the experiment was as shown in the table of Group II:

GROUP II.—*Fed white (polished) rice.*

	Loss in pounds.
Case No. 7	13.5
Case No. 8 [a]	10.0
Case No. 9 [a]	13.5
Case No. 10 [a]	6.0
Case No. 11 [a]	8.0
Case No. 12	7.5

In considering the cases of Group IV, we find that in case No. 20 the most striking symptoms of beriberi, which developed during the course of the experiment, were cardiac disturbances, pain and tenderness in the calf muscles, and loss of knee jerks. In case No. 26 there occurred hyperesthesia of the skin over the fingers and toes, loss of power of the grip of the hands, loss of knee jerks, and unsteadiness when standing with the eyes closed. In No. 25 the striking symptoms were weakness of the legs and tenderness in the calf muscles, and slight edema of the legs, while in No. 29 marked edema of the legs and face, epigastric pain, loss of knee jerks, cardiac disturbances, and collapse were the prominent symptoms. Death occurred on the seventy-eighth day of the experiment. In case No. 19 the suggestive symptoms were pain in the legs and arms, the feebleness of the grip of the hands, paresthesia and slight tenderness of the calves, and slight edema over the tibiæ, while in No. 22 there was marked edema of the legs and moderate tenderness of the calf muscles. In No. 21 slight cardiac disturbances, edema of the legs, and hyperesthesia of the muscles of the calves were present. The loss of weight in the subjects of this group during the course of the experiment may be seen from the table of Group IV:

GROUP IV.—*Fed white (polished) rice.*

Case No. 19 [b]	Lost 3 pounds,	then gained 5 pounds.
Case No. 20 [a]	Lost 6 pounds.	
Case No. 21	Lost 15 pounds,	then gained 8 pounds.
Case No. 26 [a]	Lost 16.5 pounds.	
Case No. 25 [a]	Lost 8 pounds.	
Case No. 22 [b]	Lost 4.5 pounds.	
Case No. 23	Lost 5 pounds,	then gained 5.5 pounds.
Case No. 24	Lost 6.5 pounds.	
Case No. 27	Lost 10 pounds,	then gained 3 pounds.
Case No. 28	Lost 6 pounds,	then gained 3.5 pounds.
Case No. 29 [c]	Lost	nothing.

In Group III, where the diet consisted largely of red rice, only 1 (No. 13) of the 6 developed rather marked symptoms of beriberi,

[a] Developed beriberi.
[b] Developed symptoms of beriberi.
[c] Developed beriberi and died of the disease.

while 1 (No. 18) developed only slight cardiac symptoms. In Nos. 14, 15, 16, and 17 no symptoms at all of the disease developed. In No. 13 the most striking symptoms suggestive of beriberi were pain and tenderness in the epigastrium, paresthesia, epigastric pulsation, cardiac disturbances and dyspnea, and marked diminution and almost disappearance of the knee jerks, so that it was very difficult or impossible at times to elicit them. The condition of this individual, at the time that his diet was changed, certainly led one to believe that had the diet been persisted with, a well-marked case of beriberi would have developed. In No. 18 epigastric pulsation and slight cardiac disturbances appeared, but these symptoms did not persist. In No. 15 erosions at the edges of the lips and conjunctivitis developed, and in No. 17 catarrhal conjunctivitis also occurred. The loss of weight in the subjects of this group during the experiment was as follows:

GROUP III.—*Fed red rice.*

Case No. 13 [a]	Lost 15 pounds.
Case No. 14	Lost 9.5 pounds.
Case No. 15	Lost 11.5 pounds.
Case No. 16	Lost 5.5 pounds, then gained 4.5 pounds.
Case No. 17	Lost 8 pounds, then gained 4.5 pounds.
Case No. 18 [a]	Lost 5.5 pounds.

From an examination of the tables showing the loss of weight in the patients in the four groups, it is seen that in some instances the loss of weight in those individuals who developed beriberi was marked—for example, No. 8 (10 pounds), No. 9 (13.5 pounds), and No. 26 (16.5 pounds). In other cases, Nos. 10, 20, and 25, it was slight, 6, 6, and 8, respectively, while in the most acute case, No. 29, there was no loss of weight at the end of 61 days, after which date no record of the weight was kept.

Cases Nos. 1 and 3 of Group I lost more in weight than any other members of the group, namely, 17.5 and 10 pounds, respectively, and were the only members of the group that developed symptoms suggestive of beriberi. No. 1 developed much more marked symptoms than No. 3. However, case No. 6 of the same group lost 9.5 pounds and developed no symptoms of the disease. Case No. 13 of Group III also lost 15 pounds in weight, more than any other member of the group, and was the only one of the group to develop striking symptoms of beriberi. But case No. 7 of Group II developed no symptoms of beriberi and lost 13.5 pounds, and case No. 21 of Group IV lost 15 pounds in the earlier part of the experiment and also developed no symptoms of the disease. Apparently, therefore, the development of the symptoms of beriberi did not necessarily occur in at least all of these cases on account of the loss of weight, though it is certainly

[a] Developed symptoms of beriberi.

suggestive in cases No. 1 of Group I and No. 13 of Group III that there might be some connection between the loss of weight and the development of the symptoms. We find no record in the literature as to whether during the incubation period of beriberi there is frequently or usually a loss in weight. All of our cases which developed beriberi showed a preliminary loss of weight, varying from 6 to 16.5 pounds, with the exception of one case. In this one, death occurred from cardiac paralysis on the seventy-eighth day, and there was no loss in weight up to the sixty-first day, but rather marked edema of the face and legs.

In none of the cases was the complete picture of beriberi obtained, except in those in which white polished rice formed the staple article of diet, but in one case fed upon red rice the diagnosis of beriberi was almost definite. Indeed, we believe that had this case been encountered otherwise than in the course of this experiment the diagnosis of beriberi would have been fully justified.

The occurrence of marked symptoms of beriberi in case No. 1 and early symptoms of the disease in No. 3, both fed upon white rice together with the alcoholic extract of rice polishings, requires some comment.

The members of this group were given daily 40 cubic centimeters of the unheated alcoholic extract mixed with the rice after it was cooked; that is, they were given the amount of extract obtained from 320 grams of rice polishings or from the polishings obtained from approximately 3.2 kilograms of red rice. Even this amount, however, did not prevent some of the symptoms of beriberi from developing in two of the cases of this group. The result of the experiment with this group therefore suggests that, whatever may be the results obtained with this extract in preventing polyneuritis in fowls and in curing this condition after it has developed, for the prevention of beriberi in adult cases of beriberi the use of the protective substance in a more concentrated form if it can be obtained would appear desirable.

For the treatment of certain fulminating cases some other substances, such, for example, as the mongo bean, *Phaseolus radiatus* Linn. (katjang idjo), or yeast, are evidently far superior and much easier and cheaper to obtain.

However, Chamberlain and Vedder [38] have shown that it is possible to cure infants suffering with beriberi by means of this extract, and where the age of the child is such as to preclude the addition of the necessary nutritious articles to the diet or where milk is unobtainable, it would appear from their experiments that its use was advantageous.

Recently Tsuzuki [39] has claimed for a substance, which he calls "antiberiberin" and which consists of a concentrated alcoholic and

ethereal extract of rice bran, marked therapeutic properties for the cure of human beriberi. The strength of the extract employed and the details of the experiments are not published. Nevertheless, our experiment with Group I shows that some substance present in the rice polishings evidently has an effect in preventing the development of beriberi in adult men, since four of the six subjects of the group developed no symptoms of the disease. It also shows that the substance which seems necessary to prevent the symptoms from appearing is not contained in any large amount in this extract.

Our opinion in this respect in regard to the alcoholic extract, formed from the results of our experiments, is in accord with that of Cooper and Funk,[40] who state that "polishings appear to contain only a very small amount of the active substance," and of Funk,[41] who believes "the substance is only present in amounts probably not more than 0.1 gram per kilogram of rice." Schaumann [42] claims that only 0.5 gram of the active substance which plays only a mediating part in the metabolism is present in the rice bran, and Simpson [43] states that extracts prepared by complicated methods can prolong the life of the animals, but do not restore them fully to health. In his experiments birds gained twice as much in weight in three days' treatment with yeast as in three weeks' treatment with large doses of the extract which Chamberlain and Vedder employed in their experiments.

Evidently symptoms of beriberi may also sometimes occur in individuals (for example, Case No. 13) whose staple article of diet is red rice, when the diet is a very monotonous one, comprising but few articles, and is continued for long periods of time, and the appetite of the subject partaking of it becomes poor and he loses continually in weight.[44] The influence of work and exercise may also be a factor in such instances in preserving the appetite. None of the subjects in our experiments did any work or took practically any exercise. However, the diet in which red rice formed the staple article was obviously the most favorable one. The diet, which consisted largely of extract of rice polishings mixed with the white rice, was the next most favorable, while that one in which white rice formed the staple article of diet was the least favorable of all. It is evident from our experiments that beriberi may be produced by the prolonged consumption of a diet in which white rice constitutes the staple article of diet. Of the 17 individuals fed upon such a diet, 8 developed beriberi, and the stage of the disease was well advanced before the close of the experiment. All of these cases had distinct loss of the knee jerk, in addition to other well-marked symptoms of the disease. Symptoms of the disease appeared in some cases in from 61 to 75 days from the commencement of the diet, and the diagnosis was definite and the knee jerks gone in one case as early as the sixty-third

day of the diet. In another case the knee jerks disappeared by the one hundred and fifth day of diet.

In Fraser and Stanton's experiments no case of beriberi occurred in less than 87 days, and the majority of the cases occurred at a considerable later period, in from 120 to 160 days. However, the individuals in their experiments were engaged in hard labor in the open country. From their experiments and our own it would appear that the incubation period of beriberi is not less than 60 days. Undoubtedly the incubation period varies with the character of the diet. None of the individuals in our experiments developed symptoms suggesting scurvy.

CONCLUSIONS.

It is evident that among the individuals comprising our experiment beriberi was produced only by means of the diet, and that the disease has therefore a true dietetic causation. It is further evident from our experiments that beriberi develops owing to the absence of some substance or substances in the diet necessary for the normal physiological processes of the body. Without the supply of such substances in the food, beriberi results. Such a substance or such substances are evidently present in red rice and in rice polishings, and also in small amount in the alcoholic extract of rice polishings, and when these articles are added to what would appear to be an otherwise physiologically proper diet they usually prevent the development of the symptoms of the disease. In some instances, however, even when these substances are constituents of the diet, when the diet is without variation and composed of very few articles, and the individual suffers from loss of appetite and the assimilative functions appear to be poor and he loses markedly in weight, symptoms of beriberi may develop. However, such symptoms may be dispersed by causing a variation in the diet by the addition of other nutritious substances.

Whether the degenerations of the peripheral nerves in beriberi result directly from the lack of the nutritious substances, or whether these substances are to be regarded as activators or as catalyzers, producing the synthesis of certain other nutritive bodies, or whether they represent antibodies which neutralize the injurious influence upon the nervous tissues of other metabolic substances, is not clear. But the preventive substance or substances against human beriberi, in whatever way they act, are evidently present in such very small amounts in the alcoholic extract of rice polishings as to suggest that they are not identical with the nutritive substances and that the nutritive substances are not ingested as such in this extract; and, further, that if the lesions of beriberi are actually formed as the result of the lack of some nutrient substance this substance appar-

ently either must be formed synthetically within the body or be present as such in other articles of the diet ingested by the individuals undergoing our experiments.

It is also evident from our experiments that the disease is certainly not an infectious one in the sense in which we usually employ this term. The rigid isolation of the prisoners undergoing the test would seem to exclude the possibility of the introduction of an infectious agent through any other individual or by the introduction of any article from the outside. And although the individuals of Groups I, II, and III all mingled freely together, there was no tendency of the disease to spread in Groups I and III.

It is also noteworthy that the cases of beriberi developed under most favorable hygienic conditions with exception in regard to diet. It is not probable that the infection could have been introduced with the food, since this was all freshly cooked, and at a temperature at which only a spore-bearing organism would survive. The food was also eaten a very short time after being cooked. Moreover, if the infection had been introduced with the food the incidence of the disease should have been the same in all of the groups, which it was not. No fermentation of the rice employed occurred either before or after it was cooked, so that it would appear that the action of such bacteria as have been described by Kohlbrügge [45] and by Breaudat [45] could be excluded. It has been suggested that a diet of white rice predisposes to the disease, since it furnishes a better medium for the development of the specific organism which resides in the intestine of the host, and that the red rice or extract of polishings forms a preventive for the development of such a specific organism. There is no definite evidence of such an hypothesis, and, moreover, the results obtained in our experiment would argue against it, since in two instances, at least (Nos. 1 and 13), distinct symptoms of beriberi were present in individuals who had received these substances in the diet. Also, it can not be claimed with reason that the resistance of the individuals having been lowered by weakness and loss of weight the specific organism residing in the intestine of the individual was able to increase and multiply and produce the disease; for in several instances where the loss of weight of the individuals was marked and their general condition poor, as was manifested by the occurrence of erosions about the corners of the mouth, sore mouth and tongue, and conjuctivitis, no symptoms of beriberi developed.

Indeed, from our experiments there is no evidence of any nature which suggests that beriberi is an infectious disease, and on the contrary the evidence is definite that beriberi [in the Philippine Islands] is due to the prolonged consumption of a diet which lacks certain substances necessary for the normal physiological needs of

the human body. That the disease encountered was true beriberi was confirmed definitely by the lesions observed in the pathological study of case 29. In this case both the gross lesions encountered at necropsy, together with the degenerations in the nerves observed in the histological examination, fully verified the clinical diagnosis of beriberi.

As to the definite chemical nature of the substance or substances in the food whose presence prevents the development of beriberi further investigations are necessary, but from a practical standpoint, as we are cognizant of the etiology of the disease, its cure and prevention is a simple problem. For the prevention and cure of beriberi in man all that is necessary is that he shall be supplied with a liberal and nutritious diet suitable to the physiological needs of the body. The recent researches of Schaumann,[46] of Chamberlain, Vedder, and Williams,[47] of Funk,[48] of Axel Holst,[49] and of Simpson [50] have thrown much light upon the question of the nature of the protective substance in the diet. Nevertheless, the opinions are not yet in accord in regard to its exact chemical nature which still appears to be unknown.

Fraser and Stanton [51] have repeatedly called attention to the fact that the phosphorus content of the rice serves as an indication of the extent to which the rice has been polished and have suggested that any rice which contains 0.4 per cent of phosphorus pentoxide or more might be regarded as safe for a staple article of diet in preventing in fowls polyneuritus, and hence of beriberi in man. They state: None of the rices connected with outbreaks of beriberi yielded more than 0.26 per cent of phosphorus pentoxide. The rices substituted for these and which were effective in preventing the continuance of the outbreaks yielded not less than 0.4 per cent of that substance. More recently Heiser [52] advocates for the prevention of beriberi the passage of a law placing a tax upon rice which contains less than 0.4 per cent phosphorus pentoxide, such rice being regarded legally as a polished rice; and no tax on rice which contains 0.4 per cent or more of phosphorus pentoxide, such rice being regarded legally as an unpolished rice.

Although it seems quite definite that a rice containing this amount of phosphorus will prevent the appearance of polyneuritis in fowls, nevertheless, from our experiments it is evident that beriberi in man may be produced by rice containing 0.37 per cent of phosphorus pentoxide when it forms the staple article of a little varied diet. Therefore the question arises as to whether the margin of safety is sufficient between such a rice and that containing only 0.4 per cent of this substance. Since it has been generally admitted that the higher the phosphorus content of rice the less is the liability of that rice to produce beriberi, and since Fraser and Stanton found, as an

average result of all their examinations, that unpolished rice contained 0.54 per cent of phosphorus pentoxide, and Aron [53] found that unpolished rice in the Philippine Islands contains 0.557 per cent phosphorus pentoxide, and freshly husked rice there 0.455 per cent, before legislation is enacted it would seem to be advisable to consider carefully the question of the amount of phosphorus pentoxide which a rice should legally be required to contain in order for it to be regarded as an unpolished rice and to be exempt from taxation.

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[1] Studies from Institute for Medical Research, Federated Malay States (1909), No. 10; Lancet (1909), 1, 451.

[2] This journal (1906), 1, 709.

[3] Castellani and Chalmers, Manual of Tropical Medicine. London (1910), 888.

[4] Arch f. Schiffs-u. Trop.-Hyg. (1910), 14, Beiheft 8.

[5] Tropical diseases, London (1907), 367; Allbutt's System of Medicine (1907), 2 Pt. II, 619.

[6] Die Krankheiten der warmen Länder. Jena (1903), 265.

[7] Mense's Handbuch der Tropenkrankheiten (1905), 146.

[8] Le béribéri. Paris (1907), 1; Bull. Soc. path. exotique (1910), 3, 8.

[9] Ibid. Bull. Soc. path. exotique 1910, 63, 118, 122.

[10] Ibid. 116.

[11] Studies from Institute for Medical Research. Federated Malay States (1906), 4, No. 8, Pt. I, 91.

[12] Ibid. (1902), 2, No. 2, 58.

[13] Loc. cit.

[14] This journal, Sec. B (1910), 5, 123.

[15] Castellani and Chalmers, Manual of Tropical Medicine, London (1910), 884.

[16] Loc. cit.

[16] Loc. sit.

[17] Genees. Tyds. v. Ned. Ind. (1909), 49.

[18] Arch. f. Schiffs- u. Trop.- Hyg. (1911), 15, Beiheft, 3, 7.

[19] See Breaudat (Bull. Soc. path. exotique (1910), 3, 13, 65, 123, 128, 317); le Dantec (Ibid., 62, 118, 122); Mathis and Leger (Ibid., 352); and Kohlbrugge (K. Akademie van Wetenschappen te Amsterdam (1911), 904).

[20] Loc. cit.

[21] Arch. f. Schiffs- u. Trop.-Hyg. (1911), 15, 702.

[22] Trans. Soc. Trop. Med. and Hyg. (1911), 5, 89.

[23] Arch. f. Schiffs-u. Trop. Hyg. (1911), 15, Beiheft, 3, 11.

[24] As Shiga only found dilatation of the heart in one monkey, his subsequent conclusions seem hardly justified.

[25] Trans. Soc. Trop. Med. and Hyg. (1911), 5, 81.

[26] This journal, sec. B. (1911), 6, 395.

[27] Bull. soc. path. exotique (1911), 4, 588.

[28] Virchow's Arch. (1897), 148, 523.

[29] Studies from Institute for Medical Research, Federated Malay States (1911), No. 12, 28.

[30] Arch. f. Schiffs-u. Trop. Hyg. (1910), 15, Beiheft, 8, 220.

[31] This journal, sec. B. (1910), 5, 95.

[32] Arch. f. Schiffs-u. Trop. Hyg. (1911), 15, Beiheft, 3, 13.

[33] Studies from Institute for Medical Research, Federated Malay States (1902), 2, No. 2, 63.

[34] Journ. Hyg. (1904), 4, 129.

[35] This committee was composed of M M. Bréaudat, Le Dantec, Jeanselme, Kermorgant, Marchoux Pottevin, and its report did not reach us until after our experi-

ments were commenced. The important researches which have been performed by various investigators upon the subject are recorded in this excellent report and the dietetic origin of the disease indorsed. See Bull. Soc. path. exotique, 1911 (Nov. and Dec.), 4, 575, 656.

[36] Throughout this article the term "white rice" will be used to indicate the highly polished rice and the term "red rice" the unpolished rice.

[37] This journal, sec. B (1911), 6, 254; (1912), 7, 40.

[38] Bull. Manila Med. Soc., February (1912).

[39] Arch. f. Schiffs- u. Trop.-Hyg. (1912), 16. Beiheft 4, 207.

[40] Lancet (1911), 2, 1266.

[41] Journ. Physiol. (1911), 43, 1400.

[42] Arch. f. Schiffs- u. Trop.-Hyg. (1912), 16, 357.

[43] Trans. Soc. Trop. Med. and Hyg. (1911), 5, 87.

[44] Obviously the food comprising our diets was not subjected to steaming or to prolonged high temperature in cooking as is frequently the case with tinned articles of food.

[45] Loc cit.

[46] Arch. f. Schiffs-u, Trop.-Hyg. (1912), 16, 28. This article also gives the references to this author's earlier publications on this subject.

[47] This journal, sec. B. (1912), 7, 39. This article also gives the references to the earlier publications of these authors.

[48] Journ. Physiol. (1911), 43, 395.

[49] Trans. Soc. Trop. Med. and Hyg. (1911), 5, 76.

[50] Ibid., 87.

[51] Loc. cit. and also Lancet (1911), 2, 1159.

[52] Journ. Trop. Med. and Hyg. (1912), 15, 124.

[53] This journal, sec. B. (1910), 5, 81, 98.

ZUR DIFFERENTIALDIAGNOSE DER BLUTMIKROFILARIEN.

Prof. Dr. F. Fülleborn, Hamburg.

Bekanntlich ist nach Manson einer der Hauptunterschiede zwischen *Mikrofilaria nocturna* und *diurna* die verschiedene, für beide Arten typische Lagerung im Ausstrichpräparat. Dies Kriterium ist aber insofern nicht ganz zuverlässig, als bei dem langsamen Trocknen in der feuchten Nachtluft der Tropen die Mikrofilarien vom Bancroftitypus ganz so gelagert sein können wie eine Diurna. Ein gutes, neues Unterscheidungsmerkmal scheint mir die Lage des letzten, mit starker Hämatoxylinfärbung darstellbaren Kernes am Schwanzende zu sein: bei Diurna liegt er fast an der äussersten Schwanzspitze, bei Nocturna in circa 95 Prozent der Gesamtlänge des Wurmes.

Das beste Unterscheidungsmerkmal bildet jedoch die von mir in die Filarienuntersuchung eingeführte und von Rodenwaldt weiter ausgebildete Vitalfärbung, wozu Azur II am geeignetsten ist. Für rein diagnostische Zwecke brauchbar ist auch die Verwendung gewöhnlicher Trockenausstriche, die mit Azur II überfärbt und dann differenziert werden. Sehr gute Bilder erhält man nach der letztgenannten Methode, wenn statt der gewöhnlichen Trockenausstriche nach Looss in heissem Akohol fixierte Feuchtausstriche verwendet werden.

Die in Bezug auf Gestalt und Lage der Exkretionszellen und der Rodenwaldt'schen Genital-Zellen zwischen *Mikrofilaria nocturna* und *diurna* bestehenden Unterschiede konnten in allen Hauptpunkten bestätigt werden, nur möchte ich die von Rodenwaldt als Genitalporus angesprochene Oeffnung entsprechend der Looss'schen Auffassung für den Analporus halten.

Durch die Vitalfärbung konnte auch der sichere Nachweis erbracht werden, dass *Mikrofilaria diurna* und *Mikrofilaria loa* absolut identisch sind.

Die genaueren Einzelheiten der Mikrofilarienanatomie können nicht ohne zahlreiche Abbildungen wiedergegeben werden.

SUNLIGHT.

Paul C. Freer [1] and H. D. Gibbs.

Five years ago, the study of the effect of tropical sunlight was commenced in this laboratory by the investigation of certain chemical reactions which are catelized by light. The causes of the coloration of phenol and aniline were first studied and the reaction products isolated. Since prior attempts in this direction in other parts of the world had proved to be a failure, we naturally surmised that the reactions were more rapid in the Tropics, producing products in sufficient quantities to facilitate their identification, a conclusion, which, at this time, we do not feel was entirely justified. By means of a chemical photometer, comparisons of light intensities in various localities, in and out of the Tropics, showed that on clear days the rates of reaction were practically uniform in all of the places investigated. The work was then extended to the study of the effects of the sun's rays upon experimental animals and upon human beings. A statement of the results obtained in all of these phases of the work is given in this paper.

The influence of sunlight in the Tropics has been the subject of extended discussion for many years and the intensity of insolation has generally been considered to be the dominating factor. In considering the question of what may be regarded as a tropical climate, we are too apt to be influenced by preconceived opinions, and to lose sight of the fact that there is as much difference between tropical climates as between those in the Temperate Zone. It can readily be understood that a place recognized to be within the Tropics, may, by reason of its proximity to the sea, its altitude, its relation to mountain chains and other natural surroundings, have a climate so modified that the actual sunlight may have less influence than in localities which are situated upon the borders of, or even well within, the Temperate Zone.

The races native to the Tropics, where the absence of a pronounced winter is favorable to the rich development of microscopical life, have no knowledge of bacteriology and pathology which would enable them to understand protective measures to avoid infectious and other diseases, and as a rule they do not have access to the complete food supplies of persons in temperate zones. As a consequence, many of the ill effects which are attributed to sunlight, may, in reality, be due to entirely different causes. The subject under discussion is so complex and is influenced by so many factors, that at the present time, general conclusions, excepting in so far as they are born out by experimental evidence, are premature.

1. A STUDY OF CERTAIN CHEMICAL REACTIONS CATALYZED BY SUNLIGHT.

It has long been known that some benzene derivatives, such as most phenols and amino compounds, undergo changes in the light with the formation of colored compounds. In the case of phenols one of us has shown that the formation of the colored compounds is due to oxidation which, in every case examined, results in the production of quinones. While decompositions and condensations set in, the first and most important colored compound formed is a quinone. In the sunlight, the reactions involved depend only upon the presence of oxygen, and the mechanism of the reactions can be explained by the presence of the labile hydrogen atom. The activity of the various phenoles can be predicted by the presence of enol-keto tautomers, which Baly[2] and his coworkers have shown can be determined from the study of the absorption spectra of the compounds in solution. This tautomeric condition is recognized through the formation of an absorption band which lies in the ultra violet region of the spectrum. When the enol-keto tautomers are in the pure state, this band disappears, and its presence is characteristic of the coexistence of the tautomers in dynamic equilibrium. The tautomeric process occurring in acetylacetone and analogous aliphatic compounds causes a band similar to that produced by aromatic compounds, and in the same region of the spectrum.

The fixation of the labile hydrogen atom, precluding the formation of enol-keto tautomers, and in some cases the fixation of the hydrogen atom para to the hydroxyl group cause changes in the behavior of the absorption band and chemically increases the stability of the molecule. Aniline and methyl aniline give absorption spectra, which indicate the existence of the labile hydrogen atom.

In the presence of moisture and oxygen, the sunlight oxidation may be attributed to hydrogen peroxide, for this oxidizing agent is formed by the action of sunlight upon water and oxygen,[3] and it has been found that in the dark, hydrogen peroxide and other oxidizing agents will produce the same result as those obtained in the sunlight.

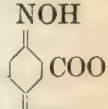
In the consideration of a structure of the benzene ring, the behavior in the sunlight of this class of compounds, containing the so-called labile hydrogen atom, is very suggestive.

It is possible that the reactions hereafter described do sometimes proceed at a more rapid rate in Manila than in higher latitudes; even if this is true, no reliable evidence is thus introduced that the sunlight is more active in the Tropics, for the temperature of the solutions exposed to the sunlight often rises to approximately 50°, and all of these reactions have high temperature coefficients.

Phenol.[4]—This compound colors very rapidly in the sunlight in presence of oxygen. The principal compound formed is quinone, and the presence of the brilliant red condensation product, phenoquinone, is highly probable. The crystals do not color so long as moisture and liquid phenol are absent, and, it seems, that the crystals are the enol form, while the liquid contains both enol and keto tautomers. Anisole undergoes no change in the sunlight.

The cresols.—The three cresols all color in the sunlight, the meta most rapidly and the ortho and para compounds much more slowly. The methyl ether of para cresol remains colorless.

The hydroxy benzoic acids and their esters.—The meta compounds color most rapidly, the otho next, and the para not at all. The esters color more rapidly than the free acids. The presence of oxygen is necessary and the cause of the coloration is oxidation. The oxidation of the meta and ortho hydroxy benzoic acids should produce the same compound as that formed from gentisic acid, namely, the para quinone of benzoic acid. This compound has been studied, and, while it has not been isolated in sufficient quantities for purification and analysis, there is every indication that it does not of necessity break down, giving off carbon dioxide as has been stated.[5]

Quinol carboxylic acid (Gentisic acid).—The esters of this acid color more rapidly in the presence of oxygen and sunlight than any of the other compounds studied. The free acid is also rapidly effected. The oxidation of the ester is easily effected in the cold by hydrogen peroxide, very dilute solutions of potassium dichromate, and potassium persulphate acidified with dilute sulphuric acid and other oxidizing agents. Potassium persulphate with dilute sulphuric acid seems to produce the best results, although it is very difficult in all cases to carry the reaction to completion without at the same time causing decomposition. No evidence of decomposition to para quinnone has been detected in the cold. The oxime  , described by Jeanrenaud[6], has not been prepared but the monooxime C_6H_3:O,:NOH, .COO.C_2H_5 has been prepared by D. S. Pratt, by the

oxidation of the ester with hydrogen peroxide in the presence of hydroxylamine-hydrochloride.[7]

Aniline.[8]—Pure aniline colors vary rapidly in the sunlight. In presence of oxygen, the colored compounds, azobenzene, 2,5-dianilinequinone, dianilinequinoneanil, and azophenine have been isolated. All of these are soluble in aniline, producing red solutions. In the absence of oxygen, i. e., in the presence of indifferent gases such as hydrogen and nitrogen, or in vacuo, the coloration is also very rapid and the principal products are azophenine, benzine, and ammonia.

Methylaniline and dimethylaniline.—Methyl aniline also colors rapidly in the sunlight and methylamine has been identified as one of the reaction products. Dimethylaniline colors much more slowly. Since no especial methods were employed to purify this compound, it is possible that the slight coloration observed after sixty days' exposure may be due to impurities.

Methyl alcohol.—Ciamician and Silber[9] have found that ethyl alcohol and quinone react in the sunlight forming acetaldehyde and quinol. Methyl alcohol[10] and quinone produce formaldehyde and quinol. Methyl alcohol in presence of oxygen and sunlight or hydrogen peroxide in the dark is oxidized to formaldehyde.

COMPARISON OF SUNLIGHT INTENSITIES.

The actual number of hours of insolation per year on the earth's surface, where the sky is always clear, is greatest at the equator and diminishes toward the Poles, the ratio between latitudes 0° and 45° being 1.83 to 1.34, although in the longer days in the Temperate Zone, the sunshine reaching the earth when the sun is near sunrise or sunset, is only a small proportion of that at midday. In the Tropics we have greater absorption and radiation by the earth's surface, factors which naturally vary with different regions according to the hours and intensity of insolation and the color of the surface exposed, being least with the green surfaces of vegetation.[11]

In the higher latitudes, the hours of insolation during the short days are so few and during the night the hours of radiation so many, that the surface of the earth steadily cools at certain times of the year, making one of the factors which causes a winter season. Many instruments have been devised to measure the sunlight intensity and, while many are useful, all fall short of accomplishing the desired result. The involved regions of the spectrum are too extensive and are subject to too great relative variations to permit of grouping as a whole for purposes of comparison.

The Angström pyrheliometer which records the total normal insolation in heat units is probably the most successful device for a general comparison, but, in the ultra-violet, its sensitiveness is much inferior to other means of measurement which we have at hand.

The chemical photometers fail for the reason that they are only sensitive to their characteristic restricted regions of the spectrum, and their usefulness is limited to comparisons of these regions. For the ultra-violet and adjacent portions of the visible spectrum, the uranyl acetate-oxalic acid solution is the most satisfactory, although it is open to several objections which will be pointed out later.

1. THE ANGSTRÖM PYRHELIOMETER.

This instrument is the best devised for comparisons of total insolation and is most sensitive to the longer wave lengths. Such data as are available have been gathered by Dr. Herbert H. Kimball, of the Mount Wilson Observatory [12]. Comparisons are made of the annual maximum intensity of solar radiation at various points as follows:

Station and latitude.	Intensity.
Cape Horn, 55° 31′ S.	1.47
Washington, 38° 54′ N.	1.44
Montpelier, 43° 36′ N.	1.60
Modena, 44° 39′ N.	1.37
Kief, 50° 24′ N.	1.39
Warsaw, 52° 13′ N.	1.35
Hald, 56° 25′ N.	1.32
Katherinenburg, 56° 50′ N.	1.58
Pavlovsk, 59° 41′ N.	1.48
Upsala, 59° 51′ N.	1.35
St. Petersburg, 59° 56′ N.	1.47
Treurenburg, 79° 55′ N.	1.29

These variations are not great, and, such as appear, are attributed by Kimball to instrumental rather than to atmospheric conditions. Angström [13] records comparisons of Guimar (altitude 360 meters) and Alta Vista (altitude 3,352 meters) in Teneriffe (20° 30′ north) as 1.38 for Guimar and 1.618 for Alta Vista, the latter high figure to be expected from the altitude.

The maximum observed by Dr. Rudolph Schneider at Vienna (48° 13′ north) [14] was 1.524 in February, and figures ranging from 1 to 1.455 are quite frequent; indeed, the observations for the time near the noon hour in Vienna, although averaging somewhat lower, bear a remarkable resemblance to those in Washington, when we consider that Kimball worked only on clear days and Schneider made observations on days of partial cloud and even of fog. Mr. Harvey N. Davis, working at Providence, R. I., in 10 months observed a maximum of 1.328 occurring in March, and, in general, his figures also bear a striking resemblance to those obtained in Vienna. Kimball, in discussing the annual march of radiation, as compiled by him, stated that "a rather surprising uniformity throughout the year (is shown) in the maximum intensity of radiation, the December minimum being only 8 per cent less than the April maximum." The departure by months from the average quinquennial mean shows that

there is a considerable variation by years, amounting to a minus quantity of as much as 18 per cent on the average for the year 1903. This diminution was widespread and such low times are periodic; the same is probably true of high periods, so that the absolute amount of insolation on the earth's surface may vary from year to year,[15] but the changes are not frequent enough or of great enough intensity to alter the picture as a whole.

Although the maximum radiation at the various points mentioned is very similar in all, yet, if we take the annual totals, we find differences for such points as have been compared. Kimball [16] has calculated the average monthly totals for Washington and Warsaw for normal surface, and from them we can obtain the yearly totals, which for Washington are 254,026 and for Warsaw 216,200, so that Warsaw actually has 85 per cent of the radiation received at Washington, although it is 14° farther north. Unfortunately, pyrheliometer readings for places in the Tropics are not at hand. We ordered an Angström pyrheliometer nearly a year ago, but the instrument has not yet arrived. When it does we will begin readings in Manila and thus obtain comparative data.

II. THE CHEMICAL PHOTOMETER, THE URANYL ACETATE—OXALIC ACID SOLUTION.

The most effective means yet discovered for comparing the intensities in the ultra-violet and adjacent regions of the visible spectrum are obtained from the rate of decomposition of the uranyl acetate—oxalic-acid solution,[17] which has been utilized extensively in this laboratory, first by Bacon,[18] whose preliminary paper on the subject has formed the basis for later work. The absorption spectrum of this solution is under investigation and this study will be published later. The other factors which influence the rate of reaction are the nature of the background, the size, shape, and material of the flasks in which the solution is exposed, and a small temperature coefficient.[19] While the reaction is complicated by more factors of importance than was originally believed and is by no means a perfect indicator, there is no doubt that, when the solution is properly employed, it affords a very useful means for comparison of light intensities of the region in which it is sensitive.

Having determined the basis of the investigation, colleagues in various parts of the world were asked to cooperate by a series of measurements with calibrated flasks and standard solutions exposed to the sunlight between the hours of 9 and 12 on a dull black surface, removed from side reflections. Returns from Manila (latitude 14° 36′ north) (Table I), Baguio (latitude 16° 25′ north) (Table II), Philippine Islands; Honolulu,[20] Hawaii Territory (latitude 21° 18′ north) (Table III); Kuala Lumpur,[21] Federated Malay States (latitude 3° 10′ north) (Table IV); Khartum,[22] Egypt (latitude 15° 36′

north) (Table V), in the Tropics; and Washington,[23] D. C. (latitude 38° 59′ north) (Table VI); Tucson,[24] Arizona (latitude 32° 12′ north) (Table VII); and Munich,[25] Germany (latitude 48° 8′ north) (Table VIII), are now available and are given in the following eight tables:

TABLE I.—*Manila.*

Months.	Average.	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Average temperature.	Observatory thermometer readings.	Black-bulb readings.	Clear days.
1910.									
May	13.21	17.7	3.21	15.42	6.88	32.09	37.2	46.9	10 out of 27.
June	12.62	17.1	6.08	15.87	10.05	32.85	38.0	47.6	8 out of 25.
July	13.74	17.8	4.61	15.95	10.07	33.37	36.6	47.6	7 out of 24.
August	13.11	17.5	5.11	15.14	10.07	31.27	39.3	49.3	3 out of 25.
September	10.94	17.1	1.15	13.51	6.05	30.30	35.2	47.2	4 out of 26.
October	11.78	17.45	1.71	13.88	9.33	30.61	35.5	45.9	4 out of 26.
November	9.97	17.38	1.47	13.78	6.16	28.57	33.8	44.5	1 out of 24.
December	10.03	14.61	1.19	12.44	7.12	29.18	33.1	43.9	3 out of 22.
1911.									
January	12.69	17.64	7.99	14.91	11.20	30.51	35.1	45.3	5 out of 19.
February	11.54	16.32	4.98	14.01	7.97	30.14	34.0	42.0	5 out of 22.
March	13.13	17.35	4.64	15.24	10.45	.....	36.6	46.0	11 out of 25
April	13.88	17.60	10.49	15.94	12.41	.....	37.4	48.0	6 out of 17.
May	13.27	15.09	10.28	15.48	13.06	.....	39.1	50.3	11 out of 22.
June	14.07	16.38	12.80	15.00	13.42	.....	37.9	49.5	6 out of 17.
July	11.83	14.06	7.11	13.18	10.22	.....	35.7	45.1	0 out of 11.
Average	12.45	16.82	5.52	14.65	9.64	30.889	36.3	46.6	

TABLE II.—*Baguio.*

Months.	Average.	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Observatory thermometer readings.	Black-bulb readings.	Clear days.
1911.								
March	12.5	18.7	6.9	16.2	8.2	.....	.....	5 out of 13.
April	16.1	20.6	8.3	17.9	12.1	27.3	51.2	3 out of 19.
May	16.2	19.4	11.1	17.7	14.0	27.5	51.4	
June	11.9	16.7	7.1	.....	.....	.....	.....	
Average	14.2	18.8	8.3	17.1	11.4	.....	.....	

TABLE III.—*Honolulu.*

Months.	Average.	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Average temperature.	Clear days.
1911.							
January	11.78	17.40	3.77	14.67	7.47	21.1	0.
February	13.49	16.71	6.29	15.57	10.72	21.1	7 out of 21.
March	13.82	17.76	3.48	16.26	9.48	21.6	15 out of 25.
April	14.30	17.99	5.46	16.04	10.83	22.8	13 out of 24.
May	13.85	17.64	7.89	15.87	10.62	21.1	9 out of 26.
June	13.64	17.41	6.62	15.46	11.34	21.1	15 out of 25.
July	12.45	16.85	5.53	14.53	9.35	21.1	3 out of 25.
August	14.58	18.51	9.08	16.28	11.92	21.6	10 out of 23.
September	15.30	20.77	6.57	17.07	12.02	21.1	12 out of 20.
October	14.96	18.37	8.24	16.46	12.47	21.1	14 out of 24.
November	15.0	18.62	6.23	16.48	12.63	23.5	11 out of 23.
December	12.7	17.0	6.7	15.87	9.76	22.5	11 out of 23.
1912.							
January	14.45	16.13	13.56	15.31	13.86	22.5	4 out of 5.
Average	13.9	17.8	8.9	15.8	10.9	21.7	

TABLE IV.—*Kuala Lumpur.*

Months.	Average.	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Clear days.	Temperature.
1911.							
March	15.27	17.3	12.2	16.70	13.56	5 out of 11...	31.57
April	15.21	17.5	10.4	16.76	12.79	10 out of 18..	32.56
May	15.25	17.5	9.0	16.66	11.25	7 out of 23...	32.42
June	15.45	17.3	12.2	16.7	13.97	5 out of 13...	32.80
July	14.53	17.3	9.3	15.6	13.09	5 out of 26...	32.72
August	15.39	18.1	11.6	16.2	13.62	6 out of 25...	32.06
September	15.94	17.5	12.0	16.91	13.99	11 out of 21..	31.76
Average	15.29	17.5	11.0	16.52	13.18		32.27

TABLE V.—*Khartoum, Egypt.*

Months.	Average.	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Maximum temperature.	Clear days.
1911.							
September	17.4	19.6	14.8	17.8	16.5	40.2	12 out of 22.
October	17.8	20.8	16.1	18.7	17.3	38.9	22 out of 31.
November	18.2	19.2	15.4	18.9	17.3	39.7	24 out of 30.
Average	17.8	19.5	15.4	18.5	17.0	39.6	

TABLE VI.—*Washington, D. C.*

Months.	Average.	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Clear days.
1910.						
June	9.91	12.70	6.54	11.55	7.18	5 out of 8.
July	11.19	15.60	1.70	12.80	7.19	10 out of 14.
August	10.37	15.75	1.85	12.75	6.81	8 out of 10.
September	11.38	19.14	3.83	13.49	8.37	10 out of 18.
October	12.91	16.66	4.37	15.05	10.16	14 out of 16.
November	11.29	17.33	3.54	14.38	8.82	4 out of 9.
December	11.51	15.85	5.00	14.15	9.27	8 out of 11.
1911.						
January	12.97	16.42	9.52	14.77	11.53	8 out of 9.
February	15.01	20.34	9.66	20.07	11.64	4 out of 5.
March	11.96	12.63	11.29	12.63	11.29	3 out of 3.
April	13.09	13.48	12.32	13.48	12.32	
Average	11.96	15.99	6.33	14.10	9.50	

TABLE VII.—*Tucson, Ariz.*

Date.	Average.	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Clear days.	Average temperature.
1910.							
October	11.5	13.4	7.7	.....	.....	4 out of 6....	28.7
1911.							
December	14.44	18.47	6.07	16.21	11.15	15 out of 20..	19.8

TABLE VIII.—*Munich.*

Date.	Average.	Maximum.	Minimum.	Mean maximum.	Mean minimum.	Clear days.	Average temperature.
June	13.10	16.89	5.25	15.55	9.65	4 out of 12...	18.5
July	14.72	17.49	6.76	16.16	11.68	14 out of 31..	22.9
August	13.91	18.15	4.80	16.31	8.91	13 out of 31..	22.3
September	10.29	17.05	.81	13.97	5.47	8 out of 30...	17.2
October	7.54	14.41	1.35	10.37	3.61	3 out of 31...	10.0
November	3.42	9.71	.56	6.48	1.55	0 out of 30...	5.1
December	2.39	6.09	.36	3.86	1.30	0 out of 21...	1.3
January	1.74	3.75	.64	3.13	.81	0 out of 5....	2.4
Average	8.39	12.94	2.56	10.73	5.37	.....	11.8

The figures are all given in per cent of oxalic acid decomposed in one hour and are, so nearly as possible, reduced to uniform conditions.

In Manila (Table I) the average per cent of oxalic acid decomposed for one hour during one year was 12.45, with a maximum of 17.8 for the highest observed day, and a minimum of 1.15. The average of all days above the general mean was 14.65 and below 9.64. Strange to relate, the lower average in Manila did not fall during the rainy months of July to October, but occurred in November, and the clear months of January, February, and March did not show so high a figure as the comparatively cloudy ones of June and July.

Kuala Lumpur (Table IV) shows a slightly higher average, 15.29, as against 12.45, and a somewhat higher maximum (18.1 against 17.8) and a much higher minimum, namely, 9.0 as against 1.15 for Manila. On average clear days in Kuala Lumpur the insolation in regard to the rays under discussion is practically the same as in Manila, but the cloudy and hazy weather of our island climate shuts off a proportion of the sunlight. The total effect is that of a climate having less insolation, and the difference between two places, one practically on the equator and the other 14° north, is a meteorological one, and not due to any excess per se of the shorter wave lengths in the former locality.

Honolulu (Table III) shows an average of 13.9 or 1.45 higher than Manila and only 1.39 lower than Kuala Lumpur. It had an abnormal maximum in September, 1911, of 20.77, or higher than either of these tropical places, and a minimum of 3.48. However, the average of days above the average mean is 15.8 as against 16.52 for Kuala Lumpur. No months in Honolulu are so low as the lowest in Manila (September, December; 10.94 and 10.03, respectively). Therefore, Honolulu (21° 18′ north) has, as regards the photocatalytic action of the sun's rays, a condition much like that of Manila (14° 36′ north) and Kuala Lumpur (3° 10′ north), and the extraordinarily high days observed at that place indicate that, at times, the atmosphere on Hawaii is so free from disturbances, strata of

varying density, or haze as to allow even a greater proportion of the rays having photocatalytic action to reach the surface of the earth than is the case in the localities nearer the equator. No one will venture to state that the sunlight is more oppressive in Honolulu than in the Philippines; indeed, the general temperature is lower, the average temperature at the time of the observation was 21°.1 to 22°.6, where ours in Manila was 30° to 25°. The difference among these three places under discussion is so slight that we can say that practically the photocatalytic action in all is the same.

Unfortunately, only a few data have reached us from Tucson, Ariz. (32° 12′ north) (Table VII), and these for the month of October, 1910, and December, 1911. They show a maximum of 18.47, or 0.67 higher than that of Manila and a minimum on one day of 7.7. The temperature during the observation averaged about as it does here (28°.7), and higher than at Honolulu. Doubtless, when a longer series of observations from this interesting point are at hand, we shall discover many days in Tucson where the maximum is as high as, or higher than, in Manila, and an average about the same.

The data from Washington need a little more careful analysis, as the methods followed were not always identical with the ones adopted by us as a standard, and the hours of insolation were not always the same. The results, recalculated to conform so nearly as possible to our conditions, are recorded in Table VI. So far as they are comparable, the results show that Washington, which has a winter season, presumably more atmospheric disturbances, many cloudy days, and possibly but few absolutely clear days can show at times as much effect as the four places discussed and an astonishingly high average of 11.96. One day in September gave the hourly decomposition, between 8.45 and 12.15 in the morning, of 19.14 per cent. Making allowance for the greater concentration of uranyl acetate used by Bacon, the totals in Washington are lower by about 33 per cent than in Manila, excepting the one month, November, in Manila, with an average of 9.97.

The results in Khartoum, Sudan (Table V), are extremely interesting and, perhaps, the most instructive of the series. Khartoum is close to the desert and in about the same latitude as Manila. We find here, in observations extending through the months of September, October, and November, an average of 17.8 as measured by a standard quartz flask, or as much as 5.35 higher than Manila and 2.5 higher than Kuala Lumpur, but this average is so high because of the remarkably uniform character of the insolation, the minimum being 14.8 as against 9.0 for Kuala Lumpur and 1.15 for Manila. The maximum observed day at Khartoum was 20.8, which is higher than any observation at Manila by 3.0 and 2.7 more than the highest observed at Kuala Lumpur, only two other observed days approach-

ing this, one of 20.8 at Honolulu and the other 20.6 at Baguio in the Philippines, at an altitude of 1,445 meters. In Khartoum, out of 66 days of observation, no less than 52 gave decompositions between 16.7 and 17.9, and 11 between 17.9 and 18.6. In Khartoum, therefore, we have a remarkably uniform high insolation so far as the portion of the spectrum under consideration is concerned; but, nevertheless, the days of maximum illumination do not materially differ from those in the other localities, so that the absolute intensity of the ultra-violet illumination which may reach the earth on perfectly clear days is practically the same, the only distinctions being meteorological. If we consider this uniformly high rate and its causes, it is evident that the reverse can also be true, and it would be possible to have so-called tropical climates where cloud interference and other causes would bring the average illumination below that in temperate zones. The temperatures of observations at Khartoum were somewhat higher than at Manila and Kuala Lumpur, but we observe that days of maximum temperature are not necessarily days of maximum photocatalytic decomposition.

The conditions at Munich (latitude 48° 8′ north) are, in a measure, directly opposed to those at Khartoum. Here, during November and December, there were no clear days, and the average decomposition for these months was 3.42 and 2.39 per cent, respectively. On clear days during the months of June, July, August, and September the maximum decomposition very closely approached the maxima obtained in other places.

Another interesting comparison is furnished by Bruner and Kozak,[28] working in Krakau (53° 40′ north) on bright, sunshiny days in the spiring and summer, the solutions in test tubes being exposed between the hours of 10 and 2. The background is not stated, but, as they worked before an open window, it is to be presumed that reflections did not play so important a part as with flasks placed on white paper, although the buildings had to be considered. Since the work was done in test tubes, we can not accurately compare results. Owing to the shape of the container, the variation might be considerable in amount; nevertheless, these authors, with a solution corresponding to our standard, obtained a decomposition of 15 as the maximum in their observations, so that it is apparent that, even in this latitude, days occur with a photocatalytic reactivity sufficiently high to be comparable with those in the Tropics.

In order to compare a climate at higher altitude and but little north of Manila with that of the latter city itself, a series of observations was made at Baguio (Table II) (altitude 1,445 meters). The temperatures of the nights and in the shade of Baguio are so low that it is, in many respects, an ideal resort for recuperation from the lowland climate, yet the photocatalytic action is much the same,

except that the maximum at Baguio is higher than in the lowlands (20.6 as against 17.8), being in this respect like Honolulu (20.7). The average is 14.2, or 1.75 more than in Manila and 1.09 less than Kuala Lumpur and 0.30 more than Honolulu. The black-bulb readings are practically the same. At Baguio, as is to be expected, we encounter a climate in which the rays undergoing investigation are somewhat more intense than in the lowland. The average temperature in the sun during the observations was 7° to 8° lower than in Manila.

Manila and Baguio at present are the only places where the black-bulb thermometer readings are available simultaneously with the photocatalytic measurements, and a study of individual days demonstrates that the two figures, namely, black-bulb readings and percentage of oxalic acid decomposed, are not by any means functions of each other; indeed, within reasonable limits they seem to be independent. Of course it is understood that a certain relationship exists, because naturally on clear, bright days both black-bulb and photocatalytic readings will be high, and both the reverse on cloudy ones. As an example of those variations we can cite a few figures taken from daily observations:

TABLE IX.—*Comparison between photocatalytic and black-bulb readings in Manila.*

From 9 to 12 a. m.	Weather.	Photo-catalysis.	Black bulb (mean of 3 observations).
1910.			°C.
Apr. 28	Clear	15.4	52.0
May 7	do	17.7	52.5
May 16	Slightly cloudy	13.4	54.0
May 18	Clear	16.4	52.0
June 9	do	14.7	54.5
July 5	Slightly cloudy	16.6	56.3

Comparisons of this kind can be extended almost indefinitely, but those given suffice to show that, in the same place and on apparently equally clear days, the relative proportions of the rays in the various portions of the sun's spectrum may vary considerably.

The supposedly injurious effect of tropical sunlight has been attributed, in a large measure, in the greater part of the literature, to the action of the more refrangible rays of the sun's spectrum, lying in the region of the violet and beyond in the ultra-violet, and to them have been attributed even grave morphologic changes sufficient to bring about permanent differences in races of the human family. So far as this work has gone it seems to develop that if the so-called "actinic" rays in Manila are particularly objectionable, they are the same in Honolulu and, for a certain time of the year, even in Washington and other places. However, the more we consider the ultra-violet rays of the sun's spectrum, taking cognizance

of the fact that nowhere, whether in or out of the Tropics, do they extend beyond 291 uu.,[27] understanding what a large proportion, if not all, of the direct rays are subjected to molecular scattering, reflection, absorption, and dispersion by the upper layers of the atmosphere, and, noting the slight differences between the lowlands at Manila and highlands at Baguio, we are forced to the conclusion that, on clear days, when the sun is at the same angle, they are everywhere much alike in intensity. Indeed, it appears as if the greater part of these rays which reach the earth are diffused and not direct. In concluding this topic, we must observe that it may be possible that we receive rays the nature of which we have not yet determined and which, with our present physical technique, we are not likely to determine and which may have an influence in the phenomena of insolation. The discovery of such rays, if they exist, will form an interesting and important part of this subject.

THE EFFECT OF SUNLIGHT UPON ANIMALS.

The air temperatures at higher altitudes are lower than in the lowlands, although the effect of sunlight upon animals and solid objects, such as the black-bulb thermometer, may be greater in the former case than in the latter. This may be shown by a comparison of some available black-bulb thermometer readings. At Davos, Switzerland (altitude, 1,559 meters), the average of the maximum black-bulb readings for three years was 53.8° with the highest absolute maximum of 67° in 1910; at Manila, the maximum for the year 1910–11 was 56°; at Helwan, Egypt, the highest observed was 70.8° during a period of three years; at Alexandria, Egypt, the maximum was 57° during the same period. There are places on the edge of the desert, where the atmosphere is especially clear and reflected light is present in great proportion, that exceed these figures; for example, Cairo in May and August, 1909, showed a maximum of 79.5°, and Aswan Reservoir in June, 1910, of 81°. In contradistinction to these, we have another remarkably high black-bulb reading at high altitude in Leh, Tibet (altitude, 3,517 meters), of 101.7° with a shade temperature of 23.9°. Of course these figures refer to the maxima only and do not take into consideration averages or the shade temperature which may be high or low, but it is evident that the occurrence of days of extreme insolation is not so much a matter of latitude as situation, and that even in the Tropics we might come to averages decidedly lower than in some more northern temperate climates. It is obvious that in any one of the places mentioned a living body might encounter days in which it might be more heated by solar radiation than in the Tropics, and the only question would be whether the possibility of cooling, such as is brought about by lower atmospheric temperatures, low humidity, radiations, and other means, will compensate to avoid the effect of such insolation.

A body exposed to the sun absorbs a portion of the rays and reflects a portion of them, the most perfect absorber being a substance as nearly the ideal black as is possible. It loses the heat by radiation or convection (conduction), and while black bodies absorb radiations readily they also radiate readily. It is a well-known fact that the ultra-violet rays are promptly fatal to all the lower organisms, such as bacteria, amœbæ, and protozoa; the heat effect on them being much less, and only apparent in so far as above certain temperatures they can not live. As we ascend higher in the order of animals, devices for regulating the loss of heat begin to appear, until in birds and mammals they are so well developed that but very little variation in blood temperatures is observable in the most diverse conditions of life.

Since the study of the heat effect upon such organisms appeared to be the most promising, this was first undertaken by Dr. Hans Aron,[28] of the department of physiology of the University of the Philippines, in Manila, and later, by one of us in Baguio. The subcutaneous, rectal, and skin temperatures were accurately measured by means of thermocouples and a tangent galvanometer. Monkeys are naturally at home in the Tropics, and we should suppose that these animals would best be able to stand the effects of sunlight. Their system of sweat glands [29] is not so highly organized as in man, and their physical heat regulation is to a much greater extent brought about by water evaporated by the lungs and mouth through increased respiration.

Aron found the normal subcutaneous temperature of the animal in the shade to vary from 36.6° to 38°; the rectal, from 37.9° to 39.4°. The subcutaneous temperature therefore is somewhat below the rectal. However, so soon as the animal is placed in the sun the subcutaneous temperature rises above the rectal and remains so to the end of the experiment. Animals exposed to the sun without protection, or artificial means of lowering the temperature, died in Manila in from one hour to one hour and fifty minutes, both skin and rectal temperatures steadily rising, the maximum before death being 43.5° and 42.7° to 46.3° and 44.8°. In Baguio, at a higher elevation, the animals died in even a shorter time, although the atmospheric temperatures were lower. Entirely different results are obtained if the animals are shaded even by a small area of shade, such as an umbrella or a board, all other conditions being similar, except that the direct rays are excluded. Under these conditions the skin and rectal temperatures never exceed 40°, and the animals remain healthy. Similar results are obtained if the animals are exposed to the full insolation, when care is taken to conduct away the excessive heat by means of a brisk current of air from a fan. Under these conditions the subcutaneous and rectal temperatures remain the

same as in the animal if shaded, and the monkey remains perfectly well.

In this last form of experiment the monkey is exposed to all of the rays of the sun, including those of shorter wave length. If the effects are to be attributed to the absorption of the ultra-violet rays, then surely the animal is in the same condition to absorb the latter when no blast of air is present, and their effect should be apparent. On absorption a large portion of these rays is presumably converted to heat and conducted away as such, so that we can assume that the effects which are observed on exposing this animal to the sun is one of the heat, and these conclusions are borne out at necropsies where post-mortem examinations give protocols clearly pointing to heat stroke. Monkeys inclosed in tight boxes with only the head exposed and placed in the full sun suffer no inconvenience, although the hair temperature on the scalp may reach 47°. The effects therefore are not due to penetration of the sun's rays to the brain. Of course, it must be understood that the monkey's skin is protected by fur and is not sensitive to the irritating effects of the ultra-violet rays of the sun, as is the skin of a Caucasian, who, we know, if exposed to the sun, would be sunburned, whether in a strong blast of air or not. This latter effect is due to the ultra-violet portion of the spectrum, the rays of which are easily guarded against, and the skin can, in time, amply protect itself by pigmentation. Dr. Shaklee [30] has shown that monkeys, when exposed to the sun's rays for short periods daily, acquire a sort of immunity. After a few weeks' exposure, they are able to remain in the sun for hours without ill effects. Experiments performed in Baguio [31] on rabbits gave remarkably conclusive and interesting results.

The rabbits exposed to the sun did not live as long as monkeys. White, gray, and black haired rabbits were employed in the experiments, and it was found that the black died first, the gray next, while the white rabbits were able to withstand the exposure. The subcutaneous temperatures taken with thermocouples through small slits in the lower dorsal region usually do not rise as high as those in the monkeys before death. These results are particularly interesting in relation to the question of proper clothing for the Tropics in showing the protective value of the white coat as opposed to the darker colors.

EXPERIMENTS UPON HUMAN BEINGS.

Experiments upon man are equally interesting. Here we have a subject with highly developed sweat glands, so that the means of heat regulation by evaporation are much more complete than in dogs, rabbits, or monkeys. Skin temperatures in this climate in the shade under normal conditions vary within the extreme limits of 31° to 34°,

being higher over the muscular and fatty parts of the body than over bony structure lying close to the surface. Aron made a comparison of Malays and Americans, and out of 14 observations 12 showed a slightly lower skin temperature for the Malay, the highest of all observations being 37.4°. In our experiments in Baguio all subjects exposed to the sun showed higher skin temperatures than those obtained by Aron in Manila, and all were above that of the blood, even though the air temperatures were considerably lower than in Manila. The lighter colored skins reached maxima in a shorter time than the darker, and the darker finally attained maxima higher than those of the lighter color. The theory of protective value of the darker skins would seem to be somewhat nullified by these observations.

Comparisons between an American and two dark-skinned Igorots in the first series and between a Canadian, a Tagalog, and an American negro in the second series were made by temperature measurements taken over the level of the third dorsal vertebra, the fifth dorsal vertebra, and over the upper angle of the scapula. The shade temperatures first taken showed the average of the lighter skins to be considerably lower than the dark, in some cases the differences being as great as 3.68°; namely, 29.8 for American and 33.48 for negro.

In spite of the fact that the American's temperature in the shade was, on the average, 2.9° lower than the Igorot's, on moving into the sun the three subjects (two Igorots and one American) reached, on the average, about an equal temperature, near the maximum, in 13 minutes for the American and about 30 minutes for the Igorots. The final temperatures are decidedly against the negro, slightly so against the Malay, and in favor of the Canadian and the American.

The rapid rise of the white skin is explained by the irritation of the sensory nerve endings, nerve endings in the vessel walls, or of the vessel walls themselves, producing a flushing of the skin due to a greater quantity of blood and a more rapid flow. This effect, absent in the dark-colored skins, even though they do absorb heat more rapidly, results unfavorably for the lighter colors. A greater quantity of blood flows to the exposed parts of the body and is there heated, and, moreover, it has been shown that ultra-violet light converts oxyhemoglobin into methemoglobin. Preliminary experiments upon rabbits exposed to the sun have shown that in some cases methemoglobin can be detected in the blood before death. This work is only begun, and more definite statements at this time are premature.

While the series of observations upon human beings is not extensive enough to be conclusive in comparisons of the white and dark races, they at least show that the adaptable mechanism for heat

regulation possessed by human beings is sufficient to lower the temperature and protect the individual from such fatal effects as are observable in monkeys. One fact very strikingly appears from these measurements, namely, that the skin temperatures of all the subjects reach higher points in the sunlight at the high altitude of Baguio than they do in Manila, despite the lower shade temperature of the former place. It appears that the balance between absorption of heat on the side exposed to the sun and radiation from the shaded portion [32] of the body is against the dark skins and in favor of the lighter colors. On the other hand, with the white skin we have the phenomenon of sunburn and the resultant ill effects not obtained where there is the protection of pigmentation.

Chamberlain [33] has published the results of a series of observations in which he compared the relative resistance to the Philippine climate of blond and brunette types of soldiers, and he concludes that the evidence is conflicting, and that from a consideration of the facts the blond is quite as well able as the brunette to withstand the climate.

Phalen [34] compared 500 troops in the Philippines dressed in orange red underclothing with 500 dressed in white. The experiment showed that the red underclothing added materially to the burden of heat upon the system and that the white underclothing of practically the same weight was superior in this respect.

Since the body is cooled by radiation and evaporation of moisture, it is evident that any clothing which interferes with these processes will materially add to the burden of the individual. The ideal condition would doubtless be that attained by an umbrella where the subject is constantly in the shade and the radiation and evaporation of perspiration are unobstructed. It is remarkable how instinctively, or otherwise, the native in the Tropics has adopted this form of protection. In many places, the workers in the fields will be found to wear practically no clothing and a large hat manufactured of various native fibers often so large as one meter in diameter. The nearer the white person can approach this condition, the more comfortable he will be in the Tropics, when the effects of sunlight alone are considered. The clothing should be white and as thin as possible to allow for unobstructed passage of air currents.

Relative humidity plays a most important part upon the influence of the various factors which go to make up climate in the Tropics. The higher the relative humidity, other things being equal, the less rapidly will evaporation take place and less complete will be the lowering of the temperature. As the lowering of temperature is brought about by the evaporation of sweat, it necessarily follows that those races with the best developed sweat glands will have an advantage. Mr. Elbert Clark [35] of the department of anatomy of the University of the Philippines has made an extended investiga-

tion of this subject. After many measurements on American soldiers, Philippine scouts, and persons of both color in civil life, he has come to the conclusion that the Malay possesses from 12 to 15 per cent more sweat glands than the white. Measurements on Negroes are not yet complete enough to warrant a final statement, but the results show that the race has perhaps an excess of 7 per cent. The few counts which have been made upon Negritos show 26.82 per cent excess for adults and 67.54 for youths. Nothing can as yet be said concerning the relative capacity of the individual glands of the two races. In this respect then the Malay possesses a decided advantage over the white man, which the latter can only offset by seeking greater shade. Probable injurious or disagreeable effects attributed to tropical sunlight are caused by the evenness of the climate rather than by the difference of insolation as compared with other places.

The monotony due to the absence of severe contrasts, such as are given by winters, has its effect. However, Chamberlain [36] investigated the systolic blood pressure and pulse rate in 6,847 readings and 1,489 individuals of varying lengths of residence in the Tropics, and he found that the pressures were little, if any, below those found in temperate climates. There was no progressive tendency for the pressure to increase or decrease with continued tropical residence up to a little over three years, beyond which point his observations did not extend. He concludes that the mean blood pressure for Filipinos during the period of 15 to 40 years of age does not differ from the pressure at the same age for Americans residing in the Philippines, for neither race is very materially below the figure to be expected of white men residing in temperate climate. Other investigators believe that the blood pressures are lower in the Philippines and do not think that all of Chamberlain's conclusions are entirely warranted by his data. Musgrave [37] states "there is a general lowering of the blood pressure in tropical climates and that this affects all classes and conditions of people. The normal blood pressure of the Filipino runs lower than average figures taken from temperate climates and runs much lower than the pressure in the same people while residing in temperate climates."

In conclusion, it must be pointed out that if individuals must be exposed to the sun, as in the case of troops on the march, they can be given adequate protection from the sun by light, preferably white clothing and helmets, but it must be remembered that perspiration is a great factor in keeping the body normal under these conditions and that during exercise in hot weather, much water is lost during the day. Some of the ill effects attributed to sun are probably due to rapid loss of water from the system and could be avoided if the individual were in a position to drink enough to preserve the equi-

librium. If a supply of pure water is not present, the temptation to drink available water along the road may become irresistible and sickness caused by infection from such a source may be attributed to the sun as a predisposing factor.

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[1] Paul C. Freer, M. D., Ph. D., director of the Bureau of Science, Manila, P. I. died on Apr. 17, 1912. This article is written by H. D. Gibbs, chief of the division of organic chemistry, bureau of science, and associate professor of chemistry, University of the Philippine, Manila, P. I.

[2] Baly and Collie. Journ. Chem. Soc., London (1905) 87, 1339. Baly and Eubank, Ibid., 1348. Baly and Desh. Astrophys Jour. (1906) 23, 118. Baly and Marsden. Journ. Chem. Soc., London (1908) 93, 2108. Baly and Stewart, ibid. See Hautzsch, Ber. — — — , to the contrary.

[3] Gibbs. The question of the production of hydrogen peroxide by the action of sunlight on water and oxygen. Gibbs. Phil. Journ. Sci. Sec. A. (1912), 7, No. 2.

[4] Gibbs. The compounds which cause the red color in phenol. Phil. Journ. Sci., Sec. A. (1908) 3, 357 and The oxidation of phenol; The effect of some forms of light and of active oxygen upon phenol and anisole, Ibid. (1909), 4, 133.

[5] Nef, Ber. (1885), 18, 3499.

[6] Ber. (1889), 22, 1783.

[7] Gibbs, Williams, and Pratt, Phil. Journ. Sci., Sec. A. (1912), 7, No. 2.

[8] Gibbs. The compounds which cause the red coloration of Aniline: I. The effect of oxygen and ozone and the influence of light in the presence of oxygen; II. The effect of sunlight in the absence of oxygen, etc., Ibid. (1910) 5, 9, and 419.

[9] Gazz. Chim. (1886) 16, III; and Ber. (1901) 34, 1532.

[10] Gibbs. The action of sunlight upon methyl alcohol. Phil. Journ. Sci., *Sec. A.* (1912), 7, No. 2.

[11] Hann, Handbuch der Klimatologie (1910), 2, 23, calls attention to the measurements at Chinchochre, Laoango coast, near the Equator. The regular measurements of the surface of the earth exposed to the sun gave temperatures over 75°, often 80°, and at one time nearly 85° C.

[12] Bull. U. S. Mt. Wilson Obs. (1910) 3, 100.

[13] Astrophys. Journ. (1899), 9, 342.

[14] Jahrb. d. k. k. Zentralanstalt f. meteorol. w. Geodyn (1906), n. f. 43, 12.

[15] Kimball, Ibid., 114, 115.

[16] Ibid., 103.

[17] The solution finally adopted in this laboratory consists of 5 cubic centimeters of a 1 per cent solution of uranyl acetate, 5 cubic centimeters of a 10 per cent oxalic-acid solution (hydrated), and 20 cubic centimeters of water.

[18] This journal, sec. A (1907), 2, 127, and (1910), 5, 281.

[19] Bruner and Kozak, Ztschr. f. Elektro-Chemie (1911), 17, 354, state that the reaction has no temperature coefficient, but with this we do not agree. The question is, at present, under investigation.

[20] Through the kindness of the Hawaiian Agricultural Experiment Station, Dr. E. V. Wilcox, in charge, Mr. W. T. McGeorge making the titrations, using a 200-cubic centimeter Erlenmeyer flask which has been sent to this laboratory for standardization.

[21] Through the kindness of the Institute for Medical Research, Dr. Henry M. Fraser, director, Mr. M. Barrowcliff making the titrations, a quart flask was used.

[22] Through the kindness of the Wellcome Research Laboratories. Dr. Andrew Balfour, director, Dr. W. Beam, chemist.

[23] Through the kindness of Dr. Raymond F. Bacon, Bureau of Chemistry.

[24] Through the kindness of Dr. H. Spoehr, Desert Laboratory.

[25] Through the kindness of Prof. Dr. Wilhelm Muthmann, Königlich Bayer. Techniche Hochschule.

[26] Loc. cit., 35.

[27] A large number of photographs of the sun's spectrum taken in Manila and Baguio show that the ultra-violet is cut off at about the same point that other observers have noted in various parts of the world, namely, about 291 uu.

[28] Phil. Journ. Sci., sec. B (1911), 6, 101.

[29] Aron, ibid., 110, makes the statement that monkeys have no sweat glands. During the time at his disposal, as he was going on a long leave of absence, Aron did not investigate this question completely. Dr. Shaklee, of the department of pharmacology, University of the Philippines, states that monkeys do have sweat glands. See also Blaschko, Arch. f. milkros. Anat. (1887), 30; Wimpfelheimer, Anat. Hefte (1907), 34, 492; Krause, Beitrage z. Kenntniss der Haut. d. Affen; Inaug. Dissertat., Berlin (1888), is not available. Sweat glands have been found by Mr. Clark, of the department of anatomy, University of the Philippines, in the forehead, hands, feet axillæ, and abdomina of our monkeys.

[30] Results to be published in Phil. Journ. Sci.

[31] Gibbs, H. D. The effect of sunlight upon men, monkeys, and rabbits, and a discussion of the proper clothing for protection. Phil. Journ. Sci., sec. A (1912), 7, 2.

[32] It very rarely happens that the area of the shaded portion of an animal body exposed to the sun does not greatly exceed that of the surface exposed.

[33] Phil. Journ. Sci., sec. B. (1911), *6*, 427.

[34] Ibid. (1910) 5, 525.

[35] Results to be published.

[36] Ibid., Sec. B. (1911), 6, 431.

[37] Phil. Journ. Sci., Sec. B. (1910), 5, 325. Further experiments now in progress, and results communicated by letter. These will be published shortly.

THURSDAY MORNING, SEPTEMBER 26, 1912.

DESINFEKTION AUF KRIEGSSCHIFFEN.

Marine-Generaloberarzt Dr. Richelot, Kiel, Germany.

[Unter teilweiser Benutzung von Aufzeichnungen des Marine-Oberstabarztes Dr. Riegel.]

Die Eigenart der Bordverhältnisse bringt auf Kriegsschiffen wichtige Abweichungen in der Desinfektion von den an Land gebräuchlichen Methoden mit sich. Sie sind im wesentlichen begründet durch die notwendige Beschränkung in der Wahl der Desinfektionsmittel und die gebotene Rücksicht auf die Einfachheit in ihrer Handhabung.

Im allgemeinen sind Desinfektionen grösseren Massstabes unter den wohlgeordneten Verhältnissen des modernen Kriegsschiffes selten notwendig. Der Grund dafür ist zunächst zu suchen in der allenthalben herrschenden peinlichen Ordnung und Sauberkeit. Dann aber spielt die Tätigkeit der Schiffsärzte eine grosse Rolle dabei. Der Gesundheitszustand der gesamten Besatzung wird dauernd überwacht. Infektiöse oder Verdächtige werden schnell herausgefunden und können isoliert oder ausgeschifft werden. Das Einschleppen von Krankheitskeimen durch Nahrungsmittel oder Trinkwasser wird durch deren stetige Kontrolle verhindert oder doch erschwert, der Verkehr mit dem Lande, namentlich an ungesunden Hafenplätzen, ist streng geregelt.

Trotzdem wäre es unverantwortlich, sich lediglich auf diese Vorbeugungsmassregeln zu verlassen und nicht alles zu tun, um Ansteckungskeime, falls sie auf das Schiff gelandt sind, wieder unschädlich zu machen. Denn es darf nicht verkannt werden, dass das Schiff durch seine Bauart und die Lebensverhältnisse seiner Besatzung in dieser Hinsicht schwer gefährdet ist. Das enge Zusannenleben, die unvermeidliche nahe Berührung der Schiffsbewohner, gemeinsame Schlafplätze gemeinsame Körperreinigung, gemeinsame Aufbewahrung der Hängmatten im engen Raum, gemeinsame Benutzung vieler Geräte, Vorhandensein schwer zugänglicher Ecken und Winkel—alles das sind Momente, durch die ein schnelles Umsichgreifen ansteckender Krankheiten ausserordentlich begünstigt wird. Auch die explosionartige Verbreitung von Infektionskrankheiten durch Einschleppung von Krankheitskeimen mit Nahrungsmitteln oder Trinkwasser gehört trotz aller Vorsichtsmassregeln durchaus in den Bereich der Möglichkeit. Kurz—es muss nachdrücklich verlangt werden, dass jedes Kriegsschiff jederzeit in

der Lage ist, sich vor der Ausbreitung übertragbarer Krankheiten durch zweckentsprechende, unter Umständen sehr umfangreiche Desinfektionsmassnahmen zu schützen.

Kriegsschiffe sind nicht in der Lage, die notwendigen Desinfektionen durch Kolonnen berufsmässiger Desinfektoren vornehmen zu lassen, wie es z. B. in den Grossstädten geschieht. Sie sind vielmehr zu diesem Zweck auf die eingeschifften Sanitätsmannschaften angewiesen. Zwar erhalten diese—wenigstens in der deutschen Marine—besondere Unterrichtskurse im Desinfektionswesen und gewinnen auch durch den täglichen praktischen Dienst am Krankenbett Verständnis und Blick wenigstens für die Erfordernisse der laufenden Desinfektion am Krankenbett. Ueber die Routine gewerbemässiger Desinfektoren, namentlich in der Raumdesinfektion, verfügen sie jedoch selbstverständlich nicht. Doch wird dieser Mangel dadurch ausgeglichen, dass Desinfektionen an Bord stets unter der sachkundigen Leitung und Aufsicht der Aerzte ausgeführt werden, und dass somit bei ihnen die Gefahr kritiklosen, schematischem Vorgehens nicht besteht, die bei den an Land in der Regel ärztlich nicht beaufsichtigten Desinfektionen nicht immer auszuschliessen ist. Sollten in einzelnen Fällen die vorhandenen Sanitätsmannschaften nicht ausreichen, so sind sie leicht durch die vermöge ihrer besonderen Ausbildung dafür geeigneten Krankenträger und sonstiges intelligentes und zuverlässiges Personal zu ergänzen.

Als Desinfektionsmittel könnte von vorneherein jedes Mittel an Bord verwendet werden, das sich auch an Land bewährt hat. Aber—wie schon eingangs erwähnt—die Bordverhältnisse verlangen Beschränkung in der Auswahl. Folgende Anforderungen sind zu stellen: Zuverlässige, schnelle Wirksamkeit, vielseitige Verwendbarkeit, Einfachheit in der Handhabung, geringe Raumbeanspruchung und Haltbarkeit in jedem Klima.

Von diesen Gesichtspunkten aus genügen von chemisch wirkenden Desinfektionsmitteln Sublimat, Kresolseifenlösung (bezw. Phenol), gebrannter Kalk und Formaldehyd—erstere drei vorzugsweise für die laufende, letzteres für die Raumdesinfektion bestimmt. Diese vier Mittel sind für jede nur mögliche Art der chemischen Desinfektion ausreichend. Sie müssen an Bord stets in genügender Menge vorhanden sein. Zu ergänzen sind sie, wo es die Verhältnisse gestatten, durch Chlorkalk. Dieses in vielen Fällen vortrefflich wirkende Mittel kann jedoch infolge seiner leichten Verderblichkeit nicht vorrätig gehalten, muss vielmehr jeweilig frisch beschafft werden. Seine Verwendbarkeit an Bord ist darum leider sehr beschränkt, und zwar vorwiegend auf den Hafenaufenthalt.

Sublimat und Kresolseifenlösung werden in den bekannten Mischungsverhältnissen in Wasser, gebrannter Kalk und Chlorkalk als sog. Kalkmilch und Chlorkalkmilch angewandt. Zu beachten ist,

dass Kresolseifenlösung bei Ankäufen im Auslande infolge ihrer schwankenden Zusammensetzung in verschiedenen Ländern besser durch Phenol (*Acidum carbolicum*) zu ersetzen ist, das überall von gleicher Beschaffenheit ist. Bezüglich des Kalkes ist zu bemerken, dass es sich nicht empfielt, ihn ungelöscht an Bord mitzuführen, da er in dieser Form nicht haltbar genug ist. Es ist vorzuziehen, ihn in gelöschtem Zustande (mit etwa 3 Teilen Wasser) als dicken Kalkbrei in grossen, glasierten Tongefässen aufzubewahren. Unter dieser Voraussetzung bleibt er jahrelang desinfektionskräftig. Nur ist es nötig die harte, gelbliche Schicht, die sich nach längerem Nichtgebrauch gelegentlich auf der Oberfläche durch die Einwirkung der Luft gebildet und an Wirksamkeit eingebüsst hat, zu entfernen. Gelöschter Kalk hat den Vorzug, dass er fast überall zu billigem Preise wieder zu ersetzen ist. Für die Fälle, in denen Verstopfungen von Rohren, Ventilen u. dergl. zu befürchten steht, ist Kalk- und Chlorkalkmilch vorher zu filtrieren bezw. durch Abseihen oder Absitzen zu klären.

Als Mittel für die Raumdesinfektion beansprucht das Formaldehydgas nach den neuesten Forschungen den Vorrang. In Verbindung mit Wasserdampf vernichtet es nicht nur die in der Luft schwebenden Krankheitskeime, sondern erzielt auch eine gründliche, wenn auch nur die Oberfläche betreffende Desinfektion der Wände und Gegenstände. Zwei Verfahren zur Erzeugung des Formaldehydwasserdampfes wetteifern heutzutage mit einander, die Verdampfungsapparate und die apparatlosen Verfahren, deren Leistungen im ganzen als gleichwertig bezeichnet werden können. Ein Vergleich beider ergibt bei den Apparatverfahren beträchtliche einmalige Ausgaben für die Beschaffung der kostspieligen Apparate, die bei den apparatlosen Verfahren naturgemäss fortfallen. Dafür arbeiten sie aber im Betriebe billiger als die apparatlosen Verfahren. Sie sind also überall da vorzuziehen, wo es sich um regelmässigen Grossbetrieb handelt, bei den die Anschaffungskosten für die Apparate bald herausgewirtschaftet werden können, wie z. B. bei den täglichen Wohnungsdesinfektionen in den Städten. Sie sind aber den apparatlosen Verfahren gegenüber bei nur aelegentlicher Benutzung unwirtschaftlicher. Letzteres trifft für Schiffe zu, bei deenen Raumdesinfektionen verhältnissmässig selten notwendig sind. Wenn schon dieser Grund für die apparatlosen Verfahren im Schiffsbetrieb spricht, so ist noch Folgendes zu ihren Gunsten anzuführen. Bei explosionsartig auftretenden Epidemien oder bei ausgebreiteten Ansteckungen wird es häufig von einschneidender Bedeutung sein, gleichzeitig und rasch eine grosse Reihe von Einzelräumen desinfizieren zu können. Dazu würde man aber bei den Apparatverfahren einer erheblichen Menge von Apparaten benötigen, deren Mitführung den Gesetzen der Sparsamkeit und der Raum- und Gewichtsbeschränkung zuwider-

liefe. Im Gegensatz dazu lässt sich die Forderung gleichzeitiger Desinfektion einer beliebigen Zahl verschiedener Einzelräume durch die apparatlosen Verfahren ohne weiteres erfüllen. Gegen die Apparatverfahren spricht ferner die grössere Feuergefährlichkeit, die durch die Verwendung von Spiritus bedingt ist. Ganz auszuschalten ist die Feuergefährlichkeit freilich auch bei den apparatlosen Verfahren nicht. Denn immerhin sind auchdabei Feuererscheinungen beobachtet. Indessen gehört einerseits dies Vorkommnis zu den grössten Seltenheiten, anderseits lassen sich seine Gefahren bei einiger Vorsicht mit Sicherheit vermeiden. Schliesslich erfordert die Bedienung der Apparate einige Sachkenntnis und Geschicklichkeit, während gerade die ausserordentlich einfache Handhabung einen der Hauptvorzüge der apparatlosen Verfahrenbildet. Aus den angeführten Gründen folgt also, dass zur Raumdesinfektion an Bord nur die apparatlosen Verfahren allgemeine Verwendung verdienen.

Von letzteren kommen nach den Eregebnissen modernster Forschung als unbedingt zuverlässig nur die Kalimpermanganatverfahren in Betracht. Sie beruhen auf einer ungemein heftigen chemischen Reaktion zwischen Formaldehyd und Kaliumpermanganat in Gegenwart von Wasser, welch letzteres durch die antstehende Siedehitze gleichzeitig mit dem Formaldehyd zum Verdampfen gelangt. Ob als Formaldehydträger dabei das flüssige Formalin oder das feste Paraform benutzt wird, ist für den Erfolgohne Belang. Das Formalinkaliumpermanganatverfahren ist billiger als das Paraformkaliumpermanganatverfahren. Doch spricht für letzteres die kompendiöse Form und die grössere Haltbarkeit. Aus diesem Grunde wird für die Schiffe im Ausland das Paraform- im Inland das Formalinverfahren zu bevorzuben sein. Das Kaliumpermanganat ist in Kristallform, nicht gepulvert, mitzugeben, da es in letzterem Zustande an Wirksamkeit verliert, das Formalin (Formaldehydlösung) 35 prozentig, das Paraform (polymerisiertes Formaldehyd) nach den Forderungen des belgischen oder französischen Arzneibuches oder in sonstiger guter Handelsware.

Neben diesen chemischen Desinfektionsmitteln spielt die mechanische Beseitigung von Krankheitskeimen eine grosse Rolle. Als solche ist zunächst die einfache Vonbordschaffung infektiösen Materials zu nennen, die aber selbstverständlich nur während der Fahrt auf hoher See unter den nötigen Vorsichtsmassregeln in Betrach kommen kann, ferner die Vernichtung von Krankheitskeimen durch Verbrennen, durch Kochen, ihre Fixierung durch Oelfarbenanstrich und schliesslich die Desinfektion durch strömenden Wasserdampf. Letztere ist in den Fällen ein unentbehrliches Hilfsmittel, in denen es auf Tiefenwirkung ankommt, also bei allem porösen Material. Strömender gesättiger Wasserdampf von 100° C. vernichtet in kürzester Zeit alle in Betrecht kommenden Ansteckungskeime an der

Oberfläche und in den Gewebsporen. Bedingung ist dabei nur, dass er an alle Teile der zu desinfizierenden Gegenstände wirklich in dieser Temperatur herankommen kann, und dass die in den Poren enthaltene Luft durch den Dampf verdrängt wird. Da nun Wasserdampf spezifisch leichter ist als Luft, ist es notwendig, dass er von oben her an die zu desinfizierenden Gegenstände herangeleitet wird, und dass die verdrängte Luft unten entweichen kann. Diese Bedingungen werden vollkommen nur durch Dampfkammern erreicht. Es ist bedauerlich, dass sich solche Dampfkammern bisher kaum auf Schiffen befinden, und es muss durchaus verlangt werden, dass die vorhandenen Desinfektionsmittel durch ihren Einbau vervollständigt werden. Es würde für jedes Schiff eine kleine, nur wenige cbm fassende Dampfkammer genügen, die ohne erhebliche Raum- und Gewichtsbeanspruchung an Oberdeck einzubauen wäre. Die deutsche Kriegsmarine glaubt auf den dampf als Desinfektionsmittel nicht verzichten zu können und behilft sich mit Improvisationen von Dampfkammern, über die später noch zu sprechen sein wird, die aber ihren Zweck nur unvollkommen erfüllen.

Was nun die Anzeigen zur Desinfektion anlangt, so erübrigt es sich wohl, alle Krankheiten, für die sie in Frage kommt, hier namentlich aufzuführen. Allgemein sei gesagt, dass sie bei allen bedeutungsvolleren Erkrankungen Platz zu greifen hat, bei denen mittelbare oder unmittelbare Übertragung der ausgebildeten Krankheitskeime von Mensch zu Mensch oder Tier zu Mensch möglich ist. In ihren Bereich fallen jedoch nicht die Krankheiten, bei deren Übertragung Insekten als Zwischenwirte unausgebildeter Keimformen in Frage kommen, wie beispielsweise Malaria, Gelbfieber, vielleicht auch Trypanose. Zweifelhaft kann es sein, ob Influenza Desinfektionen notwendig macht oder nicht. Indessen wird die ausserordentliche Hinfälligkeit der Influenzabazillen ausserhalb des menschlichen Körpers sowie der Umstand, dass die Krankheit gewöhnlich durch Kontakt mit Kranken oder Bazillenträgern unmittelbar von Person zu Person übertragen wird, die Desinfektion im allgemeinen entbehrlich machen und nur auf solche Fälle beschränken lassen, die mit starker katarrhalischer Absonderung verbunden sind. Auch auf die Rolle, die das Gelbfieber gegenüber der Desinfektionsfrage spielt, muss noch kurz eingegangen werden. An vielen Orten wird bei Gelbfiebererkrankungen noch desinfiziert. Nachdem aber durch zahlreiche Versuche einwandsfrei erwiesen ist, dass die Pflege Gelbfieberkranker ganz ungefährlich ist, dass selbst gründlicher Kontakt mit Blut und Ausscheidungen, mit gebrauchten, ungereinigtem Bettzeug und schmutziger Wäsche von Gelbfieberkranken keine Erkrankung zur Folge hat, dass vielmehr der Stich infizierter Stechmücken den einzigen Weg bildet, auf dem unter natürlichen Verhältnissen die Krankheit von Mensch zu Mensch übertragen wird, müssen Desin-

fektionen bei dieser Krankheit als nutzlos und überflüssig bezeichnet werden. Der Schutz vor Übertragung von Gelbfieber liegt vielmehr auf anderem Gebiete.

Was nun die Ausführung der Desinfektion anbelangt, so unterscheiden wir in althergebrachter Weise laufende und Raumdesinfektion.

Bei den Aufgaben, die der laufenden Desinfektion am Krankenbett zustehen, kann von der Besprechung der Desinfektion der Hände und anderer Körperteile, die mit dem Kranken oder verdächtigen Gegenständen in Berührung gekommen sind, sowie der Desinfektion von Instrumenten Abstand genommen werden, da ihre Methoden allgemein bekannt und anerkannt sind. Bezüglich der Unschädlichmachung von Ausscheidungen Kranker, Wund- und Geschwürsabsonderungen und der damit getränkten Verbandstoffe, von Schmutz- und Badewasser wird auf das vorhin erwähnte Verfahren hingewiesen, diese Stoffe während der Fahrt auf hoher See unter den nötigen Vorsichtsmassregeln über Bord zu geben, selbstverständlich unter Benutzung von Ausgüssen oder Aborttrichtern, die ihrerseits dann natürlich ebenso wie die Behältnisse, in denen Krankheitsprodukte sich befanden, zu desinfizieren sind. Dies Verfahren verdient während der Fahrt den Vorzug vor der Behandlung mit desinfizierenden Flüssigkeiten, bei der ein Verschütten bei den oft lebhaften Schiffsbewegungen nicht immer zu vermeiden ist. Ist das nicht angängig, so sind Absonderungen aus Nase, Rachen, Lunge, von Wunden und Geschwüren in Gefässen aufzufangen, die mit Kresolwasser oder Sublimatlösung zur Hälfte gefüllt sind. In diesen Lösungen müssen sie mindestens zwei Stunden stehen, ehe sie fortgegossen werden dürfen. Bei tuberkulösem Auswurf genügt jedoch diese Behandlung nicht immer; es ist sicherer, ihn durch Kochen der Lösung, in die er entleert ist, unschädlich zu machen. Erbrochenes, Harn und Stuhl müssen mit der ihrem Quantum gleichen Menge Kresolwasser, Kalkmilch oder Chlorkalkmilch versetzt werden und dürfen ebenfalls erst nach frühestens zwei Stunden in die Ausgüsse entleert werden. Fester Stuhl erfordert gründliche Zerkleinerung und entsprechend längere Einwirkung der Desinfektionsmittel. Schmutzwässer sind durch zweistündige Einwirkung von Kalkmilch oder Chlorkalkmilch zu desinfizieren, von denen man soviel zuzusetzen hat, dass die Mischung kräftig alkalisch reagiert bezw. starken Chlorgeruch zeigt.

Badewässer sind in derselben Weise mit filtrierter Kalkmilch oder Chlorkalkabschwemmung oder mit Sublimat zu behandeln, das in diesen Fällen nach von Esmarch bereits in ausserordentlicher Verdünnung (1:100,000) Wuchsformen abtötet, sodass 2 gr. auf 1 Vollbad (200 l.) genügen, oder sie sind—was bei vorhandener Dampfleitung das bequemste Verfahren ist—für eine halbe auf 80–90° C. zu erhitzen. Geräte, in denen Krankheitsprodukte aufgefangen sind,

Waschschüsseln und Badewannen sind nach Desinfektion ihres Inhalts mit Kresolwasser oder Sublimat (letzteres, jedoch nicht bei blanken Metallgeräten) gründlich auszuscheuern und mit heissem Wasser nachzuspülen. Sonstige Krankengeräte, Arzneigläser, Essgeschgirre u. s. w. sind 15 Minuten lang in 2 Prozent Sodalösung auszukochen und dann gründlich zu spülen. Nicht auskochbare Gegenstände, wie z. B. Fieberthermometer, sind mit Sublimat- oder Kresollösung zu desinfekzieren. Gebrauchte Verbandstücke, Speisereste, Kehricht und dergl. sind am besten zu verbrennen. Wäsche und waschbare Kleidungsstücke sind für mindestens zwei Stunden in Eimern der Wirkung von Kresollösung zu unterziehen, von der sie vollständig bedeckt sein müssen, ehe sie weiter gereinigt werden können. Nicht waschbare Kleidungsstücke, ausser solchen aus Leder oder Gummi, wollene Decken, Matratzen, Betten und dergl. sind mit Sicherheit nur durch strömenden Dampf zu desinfekzieren. Ein Abreiben mit Sublimat, Kresollösung oder eine Formaldehydbehandlung genügt für Gegenstände aus Leder oder Gummi, ist aber sonst nur für die Fälle ausreichend, in denen man mit einer Oberflächendesinfektion auszukommen glaubt. Leider fehlen Dampfdesinfektionsapparate, wie schon hervorgehoben, meistens auf Schiffen, und man ist daher auf den Notbehelf durch Improvisationen angewiesen.

In der deutschen Kriegsmarine wird folgendes Verfahren angewandt: In ein grosses Fass oder eine grosse Balje, die mit Segeltuch gut ausgekleidet werden, wird durch ein Zweigdampfrohr Dampf von 1.5 Atm. Spannung zum Boden geleitet, über dem durch kreuzweise gelegte Lattenstücke eine Art Hohlraum geschaffen ist. Etwa in dem Rohr vorhandener Schmutz wird durch Ablassen von Dampf vorher entfernt. Das Dampfrohr selbst wird umwickelt, und vor seine Mündung wird ein Stück Leinewand gebunden. In das Behältnis wird das Desinfektionsgut locker geschichtet. Darüber kommt ein mit Gewichten beschwerter, lose sitzender Deckel, der entfernt von der Einmündung des Dampfrohres ein Thermometer trägt. Durch ein Ventil im Dampfrohr wird die Dampfzuführung so geregelt, dass das Thermometer 100° zeigt. Halbstündige Einwirkung hundertgradigen Dampfes soll nach den Vorschriften für die Desinfektion genügen. Das Verfahren dürfte einer strengen Kritik kaum Stand halten. Schon der Umstand, dass der Dampf von unten nach oben, somit in einer für die Verdrängung der schwereren Luft ungünstigen Richtung dringt, gewährleistet nicht, dass er in alle Poren des übereinander geschichteten Desinfektionsgutes hineingelangt, und dass überall die notwendige Temperatur von 100° erreicht wird. In der Tat haben Versuche ergeben, dass die Abtötung von Milzbrandsporen im Inneren des Desinfektionsgutes in eine halbe Stunde noch nicht erreicht wurde, dass vielmehr dazu

60 Minuten notwendig waren. Neben der unsicheren Wirkung sind auch sonstige Nachteile vorhanden. Zunächst der nur sehr geringe Rauminhalt, der die Aufnahme grösserer Gegenstände nicht gestattet und bei reichlicherem Desinfektionsgut zu mehrmaliger Wiederholung des Verfahrens zwingt, sodann die Möglichkeit der Beschädigung der Gegenstände durch Verbrennen an dem heissen Dampfrohr und durch Rost oder Grünspan, wovor die angegebenen Vorsichtsmassregeln nicht immer genügend schützen. Aus diesen Erwägungen mag auf die Dringlichkeit des Einbaus kleiner Dampfdesinfektionsapparate nochmals hingewiesen sein. Fussboden, Bettstelle, Möbel, die Wand in der Nähe des Bettes, Türgriffe, Abortsitze u. s. w. werden durch gründliches Abscheuern mit Kresolwasser oder Sublimatlösung desinfiziert. In die Aborttrichter ist nach jeder Benutzung filtrierte Kalkmilch oder Kresolwasser zu giessen.

Nach Entfernung der Kranken oder Erlöschen der Krankheitsfälle kommt es zur Raumdesinfektion, die unter Umständen eine umfassende, eine Anzahl von Schiffsräumen in sich begreifende sein muss. Bewohnte Schiffsräume, wie Wohndecke, Messen, Kammern, Arrestzellen und dergl. werden am besten durch Einwirkung von Formaldehyd desinfiziert, wofür aus den oben angeführten Gründen apparatlose Verfahren bevorzugt werden müssen. Auf einige Einzelheiten ist hinzuweisen. Da die Desinfektionswirkung des Formaldehyds an die Lufttemperatur gebunden ist, unter 15° C. allmählich abnimmt und unter 8° C. fast gänzlich erlischt, müssen die Räume in der kalten Jahreszeit vorher durch Heizung auf 15–20° C. gebracht werden. Um Entweichen des Gases zu verhindern, müssen alle Oeffnungen, Türen, Fenster, Luken, Ventilationskanäle u. s. w. sorgfältig verschlossen und abgedichtet werden. Die künstliche Lüftung ist in dem ganzen, zu den Räumen gehörigen Teil der Kanalleitungen abzustellen. Wenn letzteres nicht durchführbar ist, muss als Gegenwirkung gegen die unvermeidlichen Druckdifferenzen die Dosis der Formaldehyderzeuger erhöht werden. Da die Wirkung des Formaldehydwasserdampfes durch Niederschlag von Formalin erfolgt, müssen warme Flächen, wie Heizkörper, heisse, an benachbarte Wärmequellen grenzende Wände und dergl. besonders desinfiziert werden, da der wirksame Formalinniederschlag an ihnen sofort wieder verdunstet. Einer besonderen Desinfektion bedürfen ferner gröbere Verunreinigungen, die durch das Formalin wegen seiner nur oberflächlichen Wirkung nicht angegriffen werden. Um den Formalindämpfen die Möglichkeit zu gewähren, an alle Gegenstände heranzukommen und sie in möglichst grosser Ausdehnung zu treffen, sind die Möbel abzurücken, durch Klötze hochzustellen, ihre Türen und Schubladen zu öffnen, Betten und Kleider frei aufzuhängen, Matratzen aufrecht hinzustellen u. s. w.

Beim Formalin-Kaliumpermanganatverfahren gebraucht man für 100 cbm Raum 3.3 kg Kaliumpermanganat, 3.3 l. Formalin und 3.3 l. Wasser, beim Paraformverfahren 1 kg Paraform, 2 kg Kaliumpermanganat und 3 l. Wasser. Diese Mengen tragen der allgemein anerkannten Forderung von 6 gr Formaldehyd auf 1 cbm Rauminhalt Rechnung. Wegen des starken Aufschäumens müssen geräumige Gefässe gewählt werden; man tut gut, die für 100 cbm Raum nötigen Reagentien auf 3 Gefässe von je 25–30 cm Durchmesser und Höhe (Eimergrösse) zu verteilen. Man benutzt Holzbottiche oder Gefässe aus Eisenblech, die zum Schutz vor etwaiger Feuersgefahr in mit trockenem Sand gefüllte Baljen bei möglichster Entfernung von entzündlichen Gegenständen gestellt werden. Auf dem Boden der Gefässe wird das fein kristallisierte Kaliumpermanganat gleichmässig ausgebreitet und darüber die Mischung von Formalin und kaltem Wasser gegossen, oder es wird—beim Paraformverfahren—Paraform und Kaliumpermanganat auf dem Boden der Gafässe gründlich gemengt und darüber kaltes Wasser gegossen. Durch Umrühren mit langen Holzstäben wird für möglichst gründliche Mischung der Bestandteile gesorgt, wozu bis zur Entwicklung der Formalindämpfe genügend Zeit bleibt. Vierstündige Einwirkung gewährleistet ausreichende Desinfektion. Unter Umständen versagt gelegentlich einmal beim Paraformverfahren die Reaktion. Das liegt an einem zufälligen Säuregehalt des käuflichen Paraforms. Ein geringer Zusatz von Natriumkarbonat (5 gr zu den obigen für 100 cbm Raum bestimmten Mengen) genügt, um sie in Gang zu bringen. Ein vorheriger Versuch mit geringfügigen Mengen wird Klarheit darüber bringen. Eine Beseitigung des Formalingeruchs durch Ammoniak nach Abschluss der Desinfektion ist unnötig; die natürliche und künstliche Lüftung genügen vollständig, um in krüzer Zeit alle Spuren zu beseitigen. Die in den benutzten Gefässen zurückbleibenden, durch das Mangansuperoxyd entstandenen braunschwarzen Flecke sind leicht mit roher Salzsäure zu entfernen.

Ist die Formalindesinfektion nicht durchführbar, so werden Fussboden und nicht mit Ölfarbe gestrichene Wände mit Kalkmilch in dünner Schicht getüncht. Dieser Anstrich ist nach 3 Stunden zu erneuern und kann nach 24 Stunden feucht abgescheuert werden. Statt Kalkmilch kann auch Kresolwasser oder Sublimatlösung angewendet werden, womit auch Möbel, Lagerstellen, Geräte, die mit Oelfarbe gestrichnen Wände, Türen, Fenster u. s. w. abzuwaschen sind. Sie sind während mindestens 2 Stunden damit feucht zu halten und sodann mit heissem Seifenwasser zu spülen. Oelfarbenwände können auch sehr zweckmässig mit frischer Oelfarbe, aber ohne vorheriges Abkratzen der alten Farbe, gestrichen werden, wodurch die Krankheitskeime wirksam fixiert werden.

Vorratsräume, Lasten, Hellegatts sind aufzuräumen und mit Kalkmilch zu streichen, desgl. Geschlossene Fässer, Kisten, Körbe u. s. w. Angebrochene Lebensmittel sind abzukochen oder zu vernichten. Besteht Verdacht, dass das Wasser in den Wasserlasten infiziert ist, so ist es, falls angängig, durch Einleitung von Dampf für eine halbe Stunde auf 80–90° C. zu erhitzen; andernfalls ist Kalkmilch, und zwar je 2 l. auf 100 l., oder Chlorkalkmilch im Verhältnis von 1:10000 zuzusetzen. Nach einstündiger Einwirkung kann das Wasser ausgepumpt werden. Auch Maschinen-, Heiz-, Kohlen-, Munitionsräume und Kettenlasten sind mit Kalkmilch, Kresolwasser oder Sublimat in der angegebenen Weise zu desinfizieren. Besteht Verdacht, dass das Bilgewasser infiziert ist, so ist Kalkbrühe eimerweise in die einzelnen Abteilungen bis zur kräftigen alkalischen Reaktion der Mischung hineinzugiessen, gründlich mit dem Bilgewasser zu verrühren und auf die Wände zu tünchen. Für die Maschinenbilge ist die Kalkbrühe durch Kresolseifenlösung zu ersetzen, weil Kalk mit den öligen Bestandteilen des Maschinenbilgewassers feste, schwer zu entfernende Krusten bildet.

DISINFECTION ON SHIPBOARD.

Surg. E. G. Parker, United States Navy.

The avenues by which contagious diseases may be transmitted on board ship are so many and varied, and frequently so difficult of discovery, that complete practical disinfection must always be regarded as doubtful.

Were these avenues confined to the matériel alone the problem would be simple. Realizing, however, that the source of infection rests most frequently with the personnel, the problem at once becomes more intricate.

The intimate personal association which characterizes life on board ship makes man-to-man transmission almost impossible to avoid, particularly as regards those diseases which are contagious from inception—for example, measles, smallpox, and scarlet fever.

For purposes of efficient disease prevention and disinfection one should always regard a ship as a single room with its thousand or more occupants all living, eating, and sleeping in closest personal contact. Under these circumstances a medical officer can never know how much damage may have been done by the first contagious case before it is discovered.

DISINFECTION OF SOURCES FROM WITHOUT.

Once having a contagious case on board, it is usually obvious that its origin is from without the ship. Such being the case, the medical officer should carefully inspect all avenues of communication with the shore. Ship visiting by parties from on shore should be forbidden.

Milk, fresh vegetables, and the like should be boiled before issue. Vegetables eaten green should not be allowed.

The bumboat and all lighters from on shore should be carefully inspected to prevent the transportation of flies, mosquitoes, and other carriers of disease. It is well known that bumboats carrying overripe fruits and sweet soft drinks, which attract innumerable flies, are a very distinct menace in a port where insect-borne disease is known to exist.

DISINFECTANTS.

The following-named disinfectants are considered most practicable and available for use on board ship:

Sunlight.—This agent is a most powerful disinfectant, and after a thorough exposure will completely destroy the vitality of many pathogenic organisms. It has been shown that tubercle bacilli contained in tuberculous sputum spread on linen and other fabrics, when exposed to sunlight, are invariably killed after an exposure of from 24 to 30 hours. The bacillus of diphtheria is very readily destroyed by this means. This agent acts best when there is free access of air and slight moisture.

The sunning of bedding and hammocks is an important item in disinfection on shipboard.

Heat.—Moist heat in the form of boiling water or steam is always available for the disinfection of mess gear and other utensils.

Chemicals.—Of the numerous chemical disinfectants in use there are four which are unquestionably the best, viz, formalin, corrosive sublimate, solution of carbolic acid, and sulphur.

Formalin, either in the form of its commercial 40 per cent solution or its liberated gas, formaldehyde, is the most generally useful in the disinfection of rooms, clothing, bedding, delicate fabrics, etc. In dilution of 1–40 it is a most satisfactory disinfectant for all discharges from the body.

Corrosive sublimate solution, 1–1,000, is most useful in disinfecting walls, decks, and wooden surfaces. It is inefficient in the presence of albuminoid matter by reason of the formation of a coagulum and albuminate on the surface of all particles, the organisms in the interior of which are thus protected.

Carbolic acid in 5 per cent strength finds its greatest use in disinfection of sinks and drains and all metallic articles.

In sulphur, by means of sulphur-dioxide gas, one has an efficient and reliable method of destroying vermin and disease-bearing animal life.

DISINFECTION OF PERSONNEL.

Once a contagious case is discovered on board ship it immediately becomes the paramount duty of the medical officer to make the area infected by this individual as limited as possible.

This is best done by prompt isolation of the patient and all his effects. The patient should be placed at once in a suitable isolation ward and his effects carefully gathered in a sheet wet with strong disinfecting solution and placed in the ward with him.

Once properly isolated, the medical officer, by using rigid disinfecting methods, can be absolutely sure that this particular individual will do no further harm.

The isolation ward should contain no unnecessary articles of furniture and should be supplied with an abundance of disinfecting material and suitable vessels for reception of the discharges.

An essential in efficient disinfection is the prevention of accumulation of infected material. Therefore, according to the nature of the disease, all infectious discharges from the patient should be treated at once. Thus, in diphtheria the discharges from the mouth, nose, and throat should receive prompt attention; in tuberculosis and pneumonia, the sputum; the discharges from the bowels in typhoid and dysentery; the urine in typhoid; and the matters thrown off by the skin in the exanthemata. With this continuous destruction of all infective discharges and emanations as soon as they appear, the chances of transmission are much reduced, and the final disinfection of the isolation room and its contents is sure to be efficient.

DISINFECTION OF DISCHARGES.

The discharges from the bowels should be received in a suitable vessel containing an amount of disinfecting solution somewhat greater than the probable amount of the evacuation. Formalin, in solution of 1:40 is the best, and after one hour's immersion sterilization is complete.

Urine.—One-fortieth of its volume of formalin added to the urine is the most practicable method of disinfecting this discharge.

Sputum.—The greatest care should be taken in the disinfection of this, for by reason of its peculiar consistency and tenacious properties it is extremely difficult of sterilization. Corrosive sublimate is here useless, for it merely coagulates, forming an albuminate which protects the innermost organisms, and upon drying these are disseminated through the air. Paper boxes, containing a piece of gauze, should be used, and when a reasonable quantity of sputum has been collected the box and its contents should be burned.

Discharges from the nose, mouth, etc.—These should be received upon pieces of gauze or old rags, which are promptly destroyed by fire.

Bed linen.—This when changed should be promptly immersed in a solution of formalin 1:40 for at least one hour, then conveyed under suitable cover to a laundry for washing. Napkins, handkerchiefs, and all body linen should be treated likewise.

Disinfection of matter thrown off by the skin.—In case of exanthemata the skin should be thoroughly oiled each day by a solution of carbolic in albolene 1 per cent, which will prevent the dissemination of infected particles of skin in the desquamation process. The following prescription is useful when itching is prominent. Acidum boricum, gr. 100; ung. aq. rosae, oz. 2. Sig. External use as needed.

Hands.—In nursing contagious diseases the infection of the hands is often unavoidable. Every time the bedpan is handled, or the person or the bed linen of the patient is touched, the nurse's hands should be scrubbed with soap and water and afterwards immersed in corrosive sublimate solution, 1:2,000, for five minutes at least.

Air.—Complete air disinfection in compartments where contagious cases are confined is impossible, yet much can be accomplished by efficient ventilation. The sole measures which will partly sift out infectious material is the placing over the exhaust louver of gauze, which is kept wet with 1:1,000 bichloride solution.

Ingress to the infected patient should be allowed only to the necessary nurse and to the medical officer.

The nurse's clothing should be a plain, easily washable material, which may be disinfected, as in case of bed linen. Hanging immediately outside the isolation ward should be a cap and gown thoroughly wet with bichloride solution, 1:1,000, and a pair of rubber overshoes kept constantly immersed in the same solution. The medical officer should don these at each visit to his patient. The isolation ward must be kept absolutely free from flies and mosquitoes, and its walls daily washed down with a 1:1,000 sublimate solution.

When the case in question has recovered and is ready for duty, the patient steps from the isolation ward entirely naked into a bath. Here he is given a thorough scrubbing with soap and water followed by an immersion in a weak bichloride solution. He receives clean linen and goes to a clean bed in the sick bay. The isolation space is then closed and fumigated with formalin overnight. In the morning the patient receives his now sterile effects and is regarded as safe to resume his association with his shipmates.

In connection with the process of disinfection or prevention of disease transmission, there should be a twice daily inspection by the medical officer himself of the entire ship's company in broad daylight.

All persons presenting symptoms suggesting the prodromata of the particular disease known to exist are to be promptly isolated with their effects and their particular discharges and emanations dealt with in the manner described as with the actual case in quarantine.

Disinfection of material—Hammocks, bedclothes, bags, etc.—Fumigation of bedding and hammocks of the entire ship's company may be readily accomplished without interfering with the ship's routine. At reveille all hammocks, bedding, and bags are placed in several

tight compartments (gun casemates answering well) and fumigated with formaldehyde gas. The number of compartments must be such as will allow the hammocks to be so placed that the gas may readily come in contact with all the surfaces. The gas is best generated by the admixture of potassium permanganate crystals with formalin in the proportion of 3½ ounces of the former to 1 pint of the latter to each thousand cubic feet of space. The fumigation by formaldehyde gas is rendered more efficient if it is done in an atmosphere well laden with moisture. This is easily obtained by blowing steam into the compartment just before starting the fumigation. The many steam leads on board ship makes this always practicable; for example, in the case of the sick bay the lead to the dressing sterilizer may be used. The receptacle in which the formalin mixture is prepared deserves consideration. To allow for splashing during ebullition the receptacle should have a capacity of about 10 times the amount of formalin mixture used.

Better distribution of the gas is obtained by using several receptacles, containing each a moderate amount of formalin mixture, rather than a single one with a large amount. Each receptacle should contain disinfectant enough for only 2,000 cubic feet of space. The agate buckets supplied the Medical Department are satisfactory for this purpose. On account of the heat generated the bucket should be placed clear of the deck on some nonconductor. An ordinary wooden deck bucket answers.

By reason of the violence of the reaction which takes place between the formalin and the potassium permanganate, the formalin should be poured over the permanganate crystals, not the permanganate dropped into the formalin.

By "hammocks" at night the bedding, etc., will be ready for distribution.

Mess gear.—After each meal the medical officer should personally see that all mess gear is sufficiently scalded to insure sterilization.

Mess tables should be scrubbed with sand and canvas and thoroughly sunned.

The remains of meals should be burned.

All prepared food should be screened from flies.

It is assumed that the ship is provided with a scuttle butt with a sanitary drinking terminal so that the medical officer may feel sure that this otherwise prolific source of contagion will not need attention.

The supply of water to the fireroom force, however, must not be forgotten.

Here the conditions are no better than they were 50 years ago. The bucket and the dirty drinking cup still prevail.

Immersion of the drinking cup in a weak formalin solution when not in use should be practiced. This is, however, but little better than nothing. Portable sanitary scuttle butts, fitted with the bub-

bling spring type of drinking terminals, have been devised and would furnish an ideal substitute for the present insanitary arrangement.

Water-closets.—Daily inspection of all water-closets should be made, and these places kept scrupulously clean.

The seats should be thoroughly scrubbed and sunned.

Spit kits.—These should contain a suitable quantity of formalin solution 1–40, and the decks about them frequently swabbed up with bichloride solution.

GENERAL DISINFECTION ABOUT DECKS.

Such spaces as can not be disinfected by gas should be thoroughly washed down with bichloride solution 1–800. Particular attention should be given to cracked and defective linoleum, where filth is likely to accumulate. This should be taken up and all dirt removed from underneath. New linoleum should replace that which is defective. Sleeping on the decks should be strictly forbidden.

Barber shop.—In the presence of contagious diseases the barber shop must receive special attention.

The barber himself should be rigidly examined to be sure he is not a disease carrier. He should cleanse his hands thoroughly each time before beginning work. Before each customer is attended, the scissors, brushes, razors, etc., should be passed through boiling water. A fresh supply of shaving soap and a clean dry towel must be furnished each customer.

The strictest cleanliness about the barber's person and his shop must be enjoined. Hair clippings must not be allowed to accumulate. Spit kits should form no part of the equipment of a barber shop, for here sputa are especially dangerous.

DESTRUCTION OF INSECTS, VERMIN, ETC.

These pests find no breeding places on board ship; they must, then, be introduced from without. Bearing this in mind, the danger from this source in an infected port is obvious. The following device will be found useful; a bottle containing a 2 per cent formalin solution is inverted in a saucer; the saucer should contain a bit of stale fish or meat well saturated with the formalin.

The fly is guided to his food solely by sense of smell; therefore the stronger the odor of the bait the more alluring it is to the fly. He partakes of the fish or meat and soon dies. The apparatus may be lashed to a small wooden bracket and hung wherever seems most suitable.

The bodies of the dead flies should be carefully swept up and burned. Especial care should be taken not to crush the flies, for their alimentary canals not only harbor pathogenic organisms, but many will actually multiply there, e. g., cholera.

The same is true of bedbugs and fleas in regard to transmission of tuberculosis and plague. It is believed that the crushing of the bodies and subsequent scratching of the bite is the common method of inoculation with plague or tuberculosis.

Mosquitoes.—All water-containing vessels should be inspected daily as being possible breeding places for the pests.

Fire buckets, empty bottles among wine stores, water pitchers and slop jars in unoccupied rooms, and the bilges, especially under fresh-water tanks, are to be remembered in this connection.

A vigorous campaign against roaches must be prosecuted. The only efficient method of thoroughly destroying animal life on board ship is by means of sulphur dioxide gas. This may be generated by burning 4 pounds of crude sulphur to each 1,000 cubic feet.

All clothing and linen should be removed beforehand and metal surfaces protected by vaseline. All forms of animal life are soon destroyed.

If destruction of rats is desired it is necessary that a ship be at a quarantine station where a sulphur furnace is available. The ship is closed and sulphur dioxide is blown in under pressure. The gas being heavy, settles upon cooling, gradually displacing the oxygen below it. The last place to contain oxygen is the area in the neighborhood of the keelson. Here the rats gather in their search for air and finally perish as the last vestige of oxygen is displaced. The bodies should then be put into corrosive sublimate solution and destroyed by fire.

FORMALDEHYD-RAUMDESINFEKTION OHNE APPARATE, MIT BESONDERER RÜCKSICHT IHRER ANWENDBARKEIT BEI DER TRUPPE IM FRIEDEN UND IM KRIEGE.

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Die Wichtigkeit der Raumdesinfektion bei der Seuchenbekämpfung hat Wissenschaft und Industrie angespornt, nach immer vollkommeneren Raumdesinfektionsmitteln zu suchen. Ein wirklich ideales Raumdesinfektionsmittel müsste ohne Belästigung der Bewohner, ohne Beschädigung der Gegenstände und ohne erhebliche Kosten in kurzer Zeit ein ganzes Zimmer mit allem, was darin ist keimfrei machen können. Dieses Ziel ist noch lange nicht erreicht! Von allen versuchten Gasen hat sich am besten noch immer der Formaldehyd bewährt. Bekanntlich wurde er von A. W. Hoffmann 1869 zuerst dargestellt und vor etwa 25 Jahren von Loew zuerst auf seine Desinfektionskraft geprüft. Von seinen Eigenschaften sind hervorzuheben: chemische Formel, $CH_2O = H-\overset{\displaystyle O}{\overset{\|}{C}}-H$, stark stechender Geruch, alle Schleimhäute stark reizend, die Lungen bis zum Bluthusten. Er ist wasserlöslich und als 40 prozentige Lösung, Formalin

genannt, im Handel erhältlich; schon in stark verdünnten Lösungen (1:30000 und schwächer) entwickelungshemmend bezw. keimtötend; Tuberkelbazillen und Sporen werden nur in konzentrierten Lösungen beeinflusst; Ungeziefer z. B. Wanzen werden durch Formaldehyd nach Kirchgässer und Hilgermann nur unsicher abgetötet. Er polymerisiert bei Wassermangel zu Paraform, einem weissen mit scharfem, an Formaldehyd erinnerndem Geruch; Paraform wird bei Gegenwart von Wasser leicht zu Formaldehyd wieder entpolymerisiert und besteht nach Auerbach und Barschall aus sechs verschiedenen Polymeren; es ist vollständig lager- und transportfähig und muss in gut verschliesbaren Gefässen aufbewahrt werden, da es andernfalls verdunstet. Bei Anwesenheit von Wasser wird es durch Metallsuperoxyde zu Ameisensäure und Kohlensäure oxydiert.

Zur sicheren Wirkung bei Formaldehyd als Raumdesinfektionsmittel sind nötig:

1) 5 gr. auf je 1 cbm. Rauminhalt. Nach Neumark entwickeln die meisten apparatlosen Verfahren weniger und geben trotzdem befriedigende Desinfektionsergebnisse (m. E. würden auch 4 gr. genügen).

2) Sättigung bezw. Uebersättigung des Raumes mit Wasserdampf. (Flügge fordert 30 gr. Wasser auf je 1 cbm. 25 gr. dürften hinreichen).

3) 5–7stündige Einwirkungszeit. M. E. sollen 5 Stunden nicht unterschritten werden.

Eine weitere Kürzung der Einwirkungszeit unter 4–5 Stunden ist nur mit unverhältnismässig grossen Steigerung der Materialmengen zu erkaufen. Will man eine gewisse Tiefenwirkung erreichen, so ist nach meinen Erfahrungen das Hauptgewicht auf lange Einwirkungszeit (24 Stunden) zu legen, denn beim Eindringen in die Tiefe der Gewebe spielt nur die sehr langsam vor sich gehende Diffusion eine Rolle; Luftbewegung fällt fort; der meiste Formaldehyd bleibt in den Wassertröpfchen auf der Oberfläche der Gewebe gelöst. Dem Formaldehyd jede Tiefenwirkung abzusprechen, wie es manche tun, halte ich für nicht richtig. Um möglichst lange eine hinreichende Gaskonzentration zu erhalten, ist eine sorgfältige Abdichtung des Raumes bei allen Formaldehyd-Raumdesinfektionen erforderlich, ferner wegen der sehr geringen Tiefenwirkung gute Ausbreitung aller Gegenstände.

Zur Formaldehyd-Wasserdampfentwicklung sind besondere Apparate hergestellt; sie haben vor allen Dingen den apparatlosen Verfahren gegenüber bei ausgedehnter Anwendung trotz der Anschaffungs- und Reparaturkosten den Vorteil der Billigkeit. Im übrigen besitzen sie eine Reihe von Nachteilen, z. B.:

1) Reparaturen meist nur von sachkundiger Hand ausführbar.

2) Transportschwierigkeiten der Apparate, und der Spiritus-Formaldehyd- und Amoniakgefässe wegen: (a) Ihres Umfanges, (b) ihres Gewichtes, (c) Empfindlichkeit gegen Stoss und Erschütterungen.

3) Abhängigkeit der auf einmal ausführbaren Desinfektionen von der Zahl der Apparate.

4) Notwendige Kenntniss; sowie relativ schwierige und langfwierige Bedienung der Apparate.

Alles dieses macht sich besonders in der Landpraxis und kleineren bezw. sehr ausgedehnten Garnisonen fühlbar, könnte aber im Kriege Raumdesinfektionen unmöglich machen. Das Bestreben ging infolgedessen dahin: Apparatlose Verfahren, mit Benutzung nur trockener, transport- und lagerfähiger, sowie nicht zu teurer Materialien zu finden.

Von den zahlreichen angegebenen apparatlosen Verfahren haben eigentlich nur drei eine grössere Verbreitung und nähere wissenschaftliche Bearbeitung erfahren: (1) Das Formalin-Kalium-hypermanganicum-Verfahren; (2) Das Autan (Paraform-Baryumsuperoxyd)-Verfahren; (3) Das Paraform-Kalium-hypermanganicum-Verfahren.

Auch auf eine Reihe anderer Methoden, soweit sie in der Literatur beschrieben sind, wird unten kurz eingegangen werden.

Das Wichtigste bei allem diesem Suchen ist die Frage, ob neben sonstiger Brauchbarkeit die Desinfektionswirkung eine hinreichende ist. Es gibt hier zu ihrer Beantwortung zwei Wege:

1) Chemische quantitative Feststellung der Menge des entwickelten Formaldehyd- und Wasserdampfes. (Wie oben erwähnt, sollen wenigstens auf 1 cbm. Rauminhalt 5 gr. Formaldehyd unter vollständiger Sättigung, bezw. Uebersättigung des Raumes mit Wasserdampf entwickelt werden.)

2) Prüfung der Formaldehyd-Wasserdampfwirkung: (a) durch chemische Mittel, (b) auf bakteriologischem Wege. Die Verfahren zur Feststellung der Menge der entwickelten Gase dienen zugleich zur Ermittelung der besten Mischungsverhältnisse der benutzten Materialien. Man kann hierzu benutzen:

1) Die direkte Bestimmung des entwickelten Formaldehyds und Wasserdampfes aus der Luft.

2) Die indirekte Bestimmung durch qualitative und quantitative Untersuchung des Rückstandes nach der vollendeten Gasentwickelung. Die direkte Bestimmung wurde zuerst von Base mit Cyankalium, nach Romyn beim Formalin-Kalium-hypermanganicum-Verfahren, von Christian bei Autanuntersuchungen mit sehr schwankenden Ergebnissen benutzt. Auch Wesenberg, Enders und andere versuchten die direkte Bestimmung der entwickelten Gasmenge. Die in Betracht kommende Untersuchungstechnik ist dann von Lockemann und Croner, sowie von Fendler und Stübler sehr vervollkommnet. Lockemann und Croner bedienten sich eines von ihnen in der Zeitschrift "Desinfektion," 1909, Heft 11 u. 12, beschriebenen Apparates; sie verarbeiteten anfangs in einem cylinderischen Glasgefäss nur etwa 5 gr. Autan, später in einem umfang-

reicheren Behälter (eiserner Autoklav von 900 l. Inhalt) grössere Mengen; 600 gr. Paraform, 1,500 gr. Kaliumhypermanganicum und 1,500 gr. H_2O. Auch Fendler und Stüber haben genaue Untersuchungen mit der direkten Methode angestellt. Nach ihrer Ansicht ist die Wärmekonzentration von der Art der verwendeten Gefässe abhängig; sie arbeiteten zwar auch mit kleinen Mengen (5 gr. Autan), glaubten aber die Fehler anderer z. B. durch Benutzung von Papier oder dünnwandigem Glas als Entwicklungsgefäss zu vermeiden. Nach ihnen ist das indirekte Verfahren zu umständlich und wegen der garnicht zu umgehenden Fehler bei Bestimmung des Rückstandes zu ungenau.

Nach anderen Autoren ist eine direkte Bestimmung des entwickelten Formaldehydgases und Wasserdampfes überhaupt nicht möglich. Da diese Verfahren alle mit verhältnismässig kleinen Mengen arbeiteten, entständen Fehler: (1) Durch andere Reaktionsintensität als bei den Desinfektionen in der Praxis; (2) durch grösseren Wärmeverlust, (3) durch grössere Absorption. Alle Fehler multiplizierten sich auf die grösseren praktischen Mengenverhältnisse berechnet vielfach. Diese Autoren bevorzugen daher das indirekte Verfahren. In erster Linie sind hier zu nennen Eichengrün, Strunk, Auerbach und Plüddemann. Auch Lockemann und Croner haben sich mit dem indirekten Verfahren beschäftigt, bevorzugen aber das direkte. Bei dem Verfahren von Strunk wird der ganze Rückstand, welcher grösstenteils aus Formalin und Ameisensäure besteht, zu CO_2 oxydiert, die sich einschlieslich der eventl. noch vorhandenen Ameisensäure dann sofort mit den aus den Superoxygen gebildeten Hydrooxyden zu kohlensauren bezw. ameisensauren Salzen verbindet; die Restmenge des übermangansauren Kaliums wird von der ursprünglichen abgezogen, und aus dieser Differenz die oxydierte Formaldehydmenge berechnet. Nach Lockemann und Croner besteht der Rückstand hauptsächlich aus: (1) Kaliumcarbonat und -bicarbonat, (2) Kaliumformiat, (3) unverändertes Formalin bezw. Paraform, (4) Manganoxyde. Sie bestimmten die Mengen dieser Substanzen und berechneten daraus die entwickelte Gasmenge. Auerbach und Plüddemann untersuchten nach besonders von ihnen ausgearbeiteten Verfahren zur Bestimmung des vergasten Formaldehyds ebenfalls die im Entwickelungsgefäss zurückbleibenden Rückstände. Auf die chemische Seite der angeführten Arbeiten und die verschiedenen chemischen Methoden noch mehr einzugehen, würde hier zu weit führen. Auf jeden Fall haben uns diese chemischen Arbeiten zur Bewertung und Verwendung der Verfahren grosse Dienste geleistet, besonders lehren sie uns die vorteilhaftesten Mengenverhältnisse der Materialien, was auf anderem Wege kaum möglich gewesen wäre. M. E. ist das erstrebenswerte Ziel bei der Formaldehydbestimmung das direkte Verfahren dass wir dieses

Ziel als erreicht ansehen können, haben wir den vorzüglichen Arbeiten von Lockemann und Croner in erster Linie zu verdanken.

Die Prüfung der Desinfektionswirkung bei den einzelnen Verfahren kann, wie oben schon erwähnt auf chemischem oder bakteriologischem Wege geschehen. Es wäre sehr wünschenswert, wenn wir ein brauchbares, chemisches Mittel zu diesem Zwecke hätten, welches eine sinnfällige Veränderung erleiden würde, sobald Formaldehyd und Wasserdampf in der nötigen Konzentration eine bestimmte Zeit eingewirkt hätten, dann würde jeder Desinfektor ohne besondere Vorkenntnisse seine Desinfektion selbst nachprüfen können. Leider ist es bisher nicht gelungen, ein brauchbares Reagenz als Indikator zu finden. Auch die Lagerfähigkeit der Reagentien für Formaldehyd ist mangelhaft. Das von Czaplewski benutzte Fuchsin-Gelatineröhrchen-Verfahren hat sich bisher nicht eingebürgert. Mir selbst ist dieses Verfahren nicht genau genug.

Somit sind wir zur Prüfung der Desinfektionswirkung in der Praxis ganz auf das bakteriologische Verfahren mittelst Testobjekte angewiesen. Meist werden hierbei pathogene und widerstandsfähige Keime an Granaten, Glasperlen, Glasplättchen, Zeugproben u. s. w. angetrocknet benutzt; sie werden an die verschiedensten Teile des Zimmers ausgelegt, teils frei, teils mehr oder weniger mit Zeug, Leinen u. s. w. zugedeckt, in Kleider versteckt, oder in teilweise geöffnete Schubkästen gelegt, um den Zutritt der Gase zu erschweren und so den praktischen Verhältnissen Rechnung zu tragen. Diese meist gewählte Verteilung in Schränken, Tischen u. s. w. ist so schwer zu beschreiben, bei der Nachprüfung kaum nachzuahmen und so ungenau, dass derartige Angaben zur exakten Vergleichsprüfung nur geringen Wert haben. Ich benutze fast ausschlieslich zu Vergleichsprüfungen Seidenfäden (Turnerseide No. 6) mit Hoffmann'schen Sporen, die mit steigender Menge Filtrierpapier umhüllt sind. Die einzelnen Päckchen werden perlschnurartig zusammengebunden und in der Höhe der Ausströmungsöffnung der Apparate bezw. in Höhe der Entwickelungsgefässe, 1 m. von ihnen entfernt aufgehängt. Diese Methode wird bei jeder Raumdesinfektion des II. Armeekorps angewandt und hat sich bisher sehr gut bewährt. Ihre nähere Beschreibung und ihre Begründung ist aus meiner diesbezüglichen Arbeit in der Zeitschrift: "Desinfektion," 1911, zu ersehen. Ich halte im allgemeinen beim Vergleich mehrerer Desinfektionsverfahren, bei denen dasselbe Gas, hier Formaldehyd, zur Anwendung kommt, eine Prüfung mit zahlreichen, verschiedenen Arten von Bakterien nicht für erforderlich, da ihre spezifische Empfindlichkeit der Formaldehydwirkung gegenüber ja bekannt ist. Ebenso sind gegen die Bewertung einer Desinfektionswirkung nach den Prozenten der abgetöteten Keime von mehreren Seiten, m. E. voll berechtigte Einwände der Ungenauigkeit erhoben.

Flügge hat schon vor Jahren bestimmte Forderungen für die Prüfung eines Formaldehyd-Raumdesinfektionsverfahrens aufgestellt. Ich habe mich bei diesen meinen Arbeiten stets nach einem bestimmten, ähnlichen aber etwas erweiterten Schema gerichtet:

1) Absterben der Krankheitserreger in einer bestimmten Zeit;
2) Gewisse Tiefenwirkung;
3) Leichte und sichere Herstellung des desinfizierenden Gases:
   a. Anforderungen an die Zahl und Ausbildung des Personals,
   b. Anforderungen an das Material: (α) Leichte Erhältlichkeit der Substanzen im Handel; (β) Leichte Dosierbarkeit des materials; (γ) Gleichmässige Güte der Handelsware und leichte Kontrollierbarkeit derselben.
   c. Beschaffung der notwendigen Geräte;
   d. Gefahrlosigkeit, besonders in bezug auf Feuergefährlichkeit.

4) Die übrige Ausführung der Desinfektion: (a) Abdichtung, (b) Luftwärme, (c) Wärme der Entwickelungsmasse, (d) Ueberwachung, (e) Zeiterfordernis.

5) Geringe Belästigung der Bewohner: (a) Dauer der Desinfektion, (b) Geruchbelästigung, (c) Beschädigung von Gegenständen durch Ueberschäumen und Umherspritzen des Materials während der Reaktion.

6) Preis des Verfahrens.

Ferner für militärische, besonders Kriegszwecke.

7) Transport- und Lagerfähigkeit des Materials: (a) Gewicht, (b) Umfang, Grösse und Form der Gefässe, (c) Haltbarkeit des Materials, (d) Wiederstandsfähigkeit der Packungen gegen: (1) Witterungseinflüsse, Feuchtigkeit, Trockenheit-Wärme, Kälte; (2) Erschütterungen.

Bei den einzelnen apparatlosen Verfahren ist Folgendes hervorzuheben:

FORMALIN-KALIUM-HYPERMANGENICUM- VERFAHREN.

Zuerst von Evans und Russel als eine Formalin-Kalium-hypermangenicum- Mischung angegeben und durch Dörr und Raubitschek durch Wasserzusatz verbessert. Benutzt werden jetzt als Materialien: (a) Formalin-wässerige 40 prozentige Formaldehydlösung, (b) Uebermangansaures Kalium, (c) Wasser. Die Reaktion verläuft folgendermassen: Oxydation des Formaldehyds durch das Superoxyd besonders zu Ameisensäure und Kohlensäure unter Wärmeentwickelung und durch die entwickelte Wärme, Verdampfen von Formaldehyd und Wasser. Zur hinreichenden Desinfektionswirkung sind an Formalin, Kalium-hypermanganicum und Wasser für 100 cbm. erforderlich nach Dörr und Raubitschek, 2.0+2.0+2.0 kg.; Lösener, 3.3+3.3+3.3 kg.; Lockemann, 2.5+2.5+1.25 kg.; Kalähne und Strunk, 2.5+2.5+1.5 kg.

Kleinere Räume erfordern verhältnismässig mehr Materialien wie grössere. Nach Lockemann und Croner werden pro cbm. Rauminhalt geliefert: Bei der Materialmenge nach Dörr und Raubitschek 3 Formaldehyd und 14.4 Wasser, mit der nach Lösener geforderten Materialmenge 5 bezw. 23.8H_2O Kirchgässer und Hilgermann desinfizierten Eisenbahnwagen II. und III. Klasse und Droschken mit sehr gutem Erfolge bei sorgfältiger Abdichtung. Auch ich habe überall bei meinen Vergleichsversuchen mit Formalin-Kaliumhypermanganicum den Apparate-Verfahren gleichwertige Ergebnisse gehabt. Bei der Ausführung der Desinfektion werden die Substanzen einfach gemischt; die Gasentwickelung setzt je nach der Temperatur der Substanzen sofort oder später, bei 15°–17° schon meist nach 3–5 Minuten stürmisch ein. Alle Vorbereitungen: Abdichten, Ausbreiten müssen vor dem Zusammenschütten der Substanzen fertig sein. Ein Ausbleiben der Reaktion ist wohl niemals beobachtet worden. Wenn auch die Ausführung der eigentlichen Desinfektion eine höchst einfache ist, so erfordern doch die Vorbereitungen, das Innehalten bestimmter Vorschriften beim Einleiten der Reaction (Temperatur der Substanzen, besonders des Wassers, der Luft, Reihenfolge der Mischung) vorgebildetes Personal, um eine brauchbare Desinfektion zu gewährleisten.

Die Substanzen sind im Handel leicht zu erhalten. Die Apotheken in Deutschland müssen sie vorrätig halten, da sie in der deutschen Pharmakopoe aufgeführt sind. Das Formalin ist 40 prozentig zu fordern und vom Kalium-hypermanganicum ist purumcrystalisatum, nicht crudum zu nehmen. Formalin und Kalium-hypermanganicum sind chemisch bekannte und leicht auf Reinheit prüfbare Substanzen. Als Entwickelungsgefäss bevorzuge ich mittelweise und, um Wärmeverluste und Feuergefährlichkeit zu vermeiden, auf Steine gestellte, dünnwandige Metallgefässe. Die von White, Wall und Dixon früher bei dem ursprünglichen Verfahren ohne Wasser beschriebenen Entzündigungserscheinungen sind nach entsprechendem Wasserzusatz nach Dörr und Raubitschek m. W. nicht wieder beobachtet. Wasser ist nie zuletzt zuzusetzen! Die Mischung der Substanzen ist möglichst rasch und gründlich auszuführen. Marmann warf sogar in die reagierende Masse brennendes Holz und Papier, ohne dass Entzündung eintrat. Wie bei dem Apparateverfahren ist auf gute Abdichtung, mittlere Wärme der Luft und der Substanzen (15°–20°) zu achten. Bei geringerer Temperatur wird wie bei jeder Desinfektion keine volle Wirkung gewährleistet, und bei höherer wird die notwendige Uebersättigung der Luft mit Wasserdampf schwerer erreicht. Bei zu hoher Wärme der Substanzen, besonders der flüssigen, tritt ferner eine zu rasche, ja explosionsartige Reaktion mit Ueberkochen und weitem Umherspritzen der Masse ein. Die eigentliche Einleitung der Gas- und Dampfentwickelung, d. h. das

Mischen der Substanzen nimmt nur wenige Minuten in Anspruch. Ein angebliches Ueberschäumen vermeidet Hilgermann durch hohe Gefässe. Ich habe dieses nicht bemerkt, jedoch je nach Lebhaftigkeit der Reaktion ein Umherspritzen der Masse auf 1–2 m. Die Flecke lassen sich durch Natron bisulfit oder verdünnte Salzsäure entfernen. In dieser Hinsicht belästigt Autan weniger. Rechnet man nach der Firma Schneider-Wiesbaden für 1 kg. Formalin 0.75 M. für 1 kg. Kalium-hypermanganicum 0.95 M., so kommt beim Verbrauch von je 2 kg. auf 100 cbm. die Formaldehyddesinfektion für 100 cbm. 3.40 M. bei je 3.3 kg. Verbrauch nach Lösener auf 5.61 M. Hilgermann berechnet beim Verbrauch von:

Zur Desinfektion.	Formalin.	Kalium-hyper-manganicum.	Wasser.	Preis.
				M.
1. Abteils, II. Klasse	750	470	375	=1.35
1. Abteils, III. Klasse	400	250	200	=0.72
1. Droschke von 2 cbm	480	300	240	=0.86

Für militärische, besonders Kriegszwecke: Das Gewicht beträgt für je 100 cbm. 4 kg. (ohne Formalingefässe). Das Material ist unbegrenzt haltbar, es zersetzt sich nicht an der trockenen Luft, nur muss die Einwirkung der Formaldehydgase besonders bei feuchter Luft auf Kalium-hypermanganicum ausgeschlossen werden. Erwärmen und Abkühlen haben in den gewöhnlichen Grenzen der Lufttemperaturschwankungen in der gemässigten Zone keinen Einfluss, abgesehen von einer Temperatur unter 0°, bei der Formalin natürlich erstarrt. Bei wärmerer Aufbewahrung ist besonders dichter Verschluss erforderlich. Glassgefässe für Formalin vertragen natürlich nur bei sorgfältiger Verpackung grosse Erschütterungen, z. B. beim Fahren, und eignen sich deshalb nicht für den Kriegsgebrauch.

AUTAN.

Es ist ein von Bayer & Co., in den Handel gebrachtes und in vielen Staaten, in Deutschland seit dem 15. September 1906 patentiertes Verfahren. Alte Autan-Packungen mit schon gemischten Pulvern, neue B.-Packungen mit getrennten Substanzen und grösseren Materialmengen (45 Prozent). Die neueren B.-Packungen sehen 80 Prozent Wasser der gesammten Materialmenge vor, die alten B.-Packungen verlangten 100 Prozent. Die grösseren Packungen enthalten zugleich Substanzen zur Amoniakentwickelung. Autan besteht aus etwa 30 Prozent Paraform, dem 10–15 Prozent Natronbicarbonicum zur Verlangsamung der Reaktion zugesetzt sein sollen und etwa 70 Prozent Baryumsuperoxyd. Auf je 1 cbm. sind etwa 50 gr. Autan berechnet. Eichengrün erklärte die Reaktion als

eine katalytische Wirkung des Formaldehyds auf Baryumsuperoxyd. Die zum Vergasen notwendige Wärme ist nach Auerbach und Plüddemann jedoch lediglich auf Oxydation des Formaldehyds durch die Superoxyde zurückzuführen. Die Katalyse spielt nach ihnen nur eine untergeordnete Rolle. Drei Teile Formaldehyd müssen nach ihnen zerstört werden, um ein Teil mit der dazu gehörigen 6fachen Menge Wasser zu vergasen.

Für Autan haben sich Wesenberg, Kolle, Schattenfroh, Selter, Formakin und Heller, Kirchgässer und Hilgermann, Enders, Gastper, Nieter und andere im wesentlichen günstig, dagegen Kirstein, Christian, Ballner, und Raibmayer, Hammerl, Ingelfinger, Bock, Böhnke mehr oder weniger abfällig ausgesprochen. Nach Ansicht einiger Autoren reichen auch die B.-Packungen bei günstigen Verhältnissen kaum zur genügenden Desinfektion aus. Zu einer Droschkendesinfektion ist eine Packung von 10 cbm. zu nehmen. Bei ungünstigen Verhältnissen: kalten Wänden, ungenügender Abdichtung, schwer zu desinfizierenden Objekten, z. B. bei Polstermöbeln muss Erhöhung der Materialmengen bis auf das Doppelte und mehr stattfinden; z. B. ist bei Eisenbahnabteilen das 1½fache, bei der Desinfektion von Kleidern in Kisten und Kleiderschränken das zehn- und mehrfache des Rauminhaltes zu nehmen. Manche Autoren verlangen Erhöhung um das Doppelte schon unter gewöhnlichen Verhältnissen. Die schlechteren Desinfektionswirkungen schoben Christian, Kirstein und Xylander auf die nicht hinreichend entwickelte Formaldehyd- und Wasserdampfmenge. Bei A.-Packungen wurden auf 1 cbm. Rauminhalt nach Christian kaum 1 gr., bei B.-Packungen nach Fendler und Stüber 1.98–2.8 gr., nach Hoffmann und Strunk 2.85–2.95 gr., nach Auerbach und Plüddemann etwa 2.5 gr. Formaldehyd und 13.6–15.6 gr. Wasser entwickelt. Scheplewski und Steinitz sahen den Grund der schlechten Wirkung in zu rascher Reaktion (4.8 Minuten und verwandten A.- und B.-Packungen zu gleicher Zeit, um so die Reaktion um einige Minuten zu verlängern, sicherlich ohne besonderen Erfolg. Bei andern apparatlosen Verfahren dauert die Reaktion auch nicht länger, trotzdem tritt bessere Desinfektion ein. Ein Vorteil liegt aber bestimmt in der halb- bis dreiviertelstündigen Gasentwickelung durch Apparate. Ebenso rasch geht es mit dem Feuchtigkeitsgehalt der Luft bei Autan; er steigt rasch bis 100 Prozent an, sinkt dann aber wieder ebenso schnell. Ausgebildetes Personal ist unbedingt erforderlich. Nur im Notfalle sollen Ungeübte nach der Vorschrift auf der Packung die Desinfektion ausführen. Dieses hat selbst Eichengrün auf dem XIV. Internationalen Hygieniker-Kongress zugegeben.

Gerade bei Autan ist sachkundiges und sorgfältiges Abdichten des Zimmers und Ausbreiten der Gegenstände erforderlich, mindestens

ebenso, wie bei den mit dem viel kräftiger wirkenden übermangansauren Kalium arbeitenden Verfahren. Autan ist als Geheimmittel unkontrollierbar. Selbst der Gedanke, dass es von einer zuverlässigen Weltfirma in den Handel gebracht wird schützt nicht vor Misstrauen. Autan wird im Kleinhandel wohl nur selten und dann nur in geringer Menge vorrätig gehalten. Die Packungen sind auf 2, 5, 10, 20, 40, 60, 80, 110, 175 cbm. Rauminhalt berechnet. Das für jede Zimmergrösse notwendige Quantum ist leicht festzustellen. Es hat stets Abrundung nach oben hin stattzufinden. Beim Entwickelungsgefäss ist in Betracht zu ziehen: auf jeden cbm. Rauminhalt sind 1 l. der Gefässgrösse zu rechnen. Es muss jeder unnötige Wärmeverlust sorgfältig vermieden werden. Oben weite, trockene Holzgefässe, oder ganz dünnwandige auf Steine, auch Holzsplitter gestellte Metallgefässe (Kessel) werden ihren Zweck am besten erfüllen. Die Autanreaktion, d. h. die Paraform-Baryumsuperoxyd-Reaktion beginnt schon nach wenigen Minuten und im Gegensatz zu den apparatlosen Verfahren mit Kalium-hypermanganicum selbst bei sehr niedriger Temperatur (+3° C.). Entzündungserscheinungen sind nicht beobachtet. Eine mittlere Temperatur 15°–20° C., nach Langermann 12°–15° C., muss zur vollen Desinfektionswirkung innegehalten werden; ebenso sollen alle Teile, besonders das Wasser nach Angabe der Fabrik etwa eine Temperatur von 20°–22° C. haben. Bei zu niedriger Lufttemperatur tritt schlechtere Desinfektionswirkung ein; bei zu hoher (über 20° C.) ist zuviel Wasserdampf zur vollständigen Sättigung der Luft erforderlich; hierzu reicht aber gerade bei Autan die gelieferte Wasserdampfmenge nicht aus, z. B. fanden Nieter und Peerenborn schlechtere Desinfektionswirkung an warmen Flächen. Zum Mischen der Pulver und des Wassers sind nur einige Minuten erforderlich; eine weitere Ueberwachung ist nicht nötig. Wenn irgend möglich, sollte man bei Autan die Einwirkungszeit auf 7 Stunden bemessen. Der oft nach der Autandesinfektion beobachtete feine Staub auf den Möbeln lässt sich ebenso, wie die oft auf den Fussboden überschäumende Masse leicht entfernen. Der Preis für 100 cbm. Rauminhalt beträgt etwa 8 M. Bei der von vielen Seiten geforderten Erhöhung der Materialmenge steigert sich der Preis entsprechend.

Die hohen Kosten dürften immer noch das Haupthindernis zur allgemeinen Einführung des Autans sein. Nach Fertigs Rechnung besteht jedoch keine grössere Kostspieligkeit in der Praxis anderen Verfahren gegenüber. Gastper berechnete den Durchschnittsgesammtpreis für die Praxis im Grossen bei Berolinaapparaten auf 9 Pf. bei Autan auf 13 Pf. für 1 cbm. Rauminhalt. Hilgermann berechnete die Kosten einer Desinfektion eines Eisenbahnwagenabteils II. Klasse mit 2.05 M, III. Klasse 1 M. Das Gewicht der Autanpackungen für 40 cbm. Rauminhalt beträgt etwa 2,600 kg., der Umfang

derselben Packung 16×11×11 cm. Bei gut gelöteten Blechbüchsen ist die Haltbarkeit der Pulver unbegrenzt, und unabhängig von Witterungseinflüssen, Feuchtigkeit, Trockenheit, Kälte und Wärme. Die Papierbeutel könnten aus besserem Papier, die Blechkästen aus widerstandsfähigerem Material sein, um Erschütterungen und Stösse z. B. beim Fahren, Umladen u. s. w. aushalten zu können. Bei den A.-Packungen, wo die Pulver gemischt enthalten waren, konnte bereits durch Vermittelung des Hydratwassers (bis 6 Prozent) eine langsam verlaufende Reaktion auf Kosten der späteren Gasentwickelung einsetzen. Autan ist in Deutschland durch ministeriellen Erlass vom 6. Juni 1907, M. 12026, als Desinfektionsmittel genehmigt. Ein anderer Erlass vom 31. August 1908 schreibt Autan u. a. als Unterrichtsgegenstand in Desinfektorenschulen vor.

PARAFORM-KALIUM-HYPERMANGANICUM-VERFAHREN.

Das Verfahren wurde August 1909 zuerst von Mayer und Hannes angegeben und dann weiter von Lockemann und Croner, von Kamanin, sowie Kalähne und Strunk ausgearbeitet. Beyer & Co. nannten ihre in den Handel gebrachten Packungen Perautan, Schering (Berlin), Paragan (Ministerialblatt 1, 8. Januar 1908, M. 8476). Ausserdem haben Lockemann und Croner Packungen von 10 gr. Paraform und 25 gr. Kalium-hypermanganicum für je 1 cbm. Rauminhalt angefertigt und auf der Hygiene-Ausstellung in Dresden ausgestellt. Es werden benutzt: (1) Paraform, (2) Kalium hypermanganicum, (3) Wasser, und zwar von Kalähne und Strunk im Verhältnis von 1:2.5:3; von Lockemann und Croner 1:2.5:2.5, von Hannes 1:3:3; von Kamanin 1:2.5:2.5. Der bei diesem Verfahren sich abspielende chemische Vorgang wird durch Entpolymerisieren des unlöslichen Paraforms in wasserlösliches Formaldehyd eingeleitet. Nach Lockemann und Croner, Kalähne und Strunk u. a. hängt die Schnelligkeit des Eintritts und die Intensität der Reaktion ab: (1) Von der Temperatur der Materialien, besonders des Wassers, (2) von der Feinheit der Pulver, (3) von der Reaktion der Materialien (Säuregehalt), (4) von der Anwesenheit leicht oxydierbarer Substanzen.

Die Alkalescenz hat auf die gelieferte Gasmenge keinen Einfluss. Die Handelssorten von Paraform geben mit übermangansaurem Kalium und Wasser nur dann eine Reaktion, wenn sie neutral oder alkalisch sind. Paraform muss jedenfalls auf Ameisen- und Essigsäure geprüft werden. Ein Prozent Soda soll stets genügen, um bei allen Kalium-hypermanganicum Handelssorten mit Paraform eine Reaktion einzuleiten. Böhnke empfiehlt statt Soda Ameisen- oder Oxalsäure zu verwenden, um den Eintritt der Reaktion zu verlangsamen. Der Eintritt der Reaktion beginnt bei sonst sehr langsam reagierenden Pulvern früher, oft sofort, wenn die Pulver einen oder mehrere Tage vorher gemischt gewesen waren. Luftfeuchtigkeit

der Zimmer scheint dabei die Hauptrolle zu spielen. Die Desinfektionswirkung ist dieselbe, wie mit dem Formalin-Kalium-hypermanganicum-Verfahren. Nach Strunk sollen auf 1 cbm. 2.85–2.95 gr. Formaldehyd kommen; Lockemann und Croner berechneten 4.75–5 Formaldehyd und 15.75–23.25H_2O. An die Zahl und die Ausbildung des Personals sind dieselben Anforderungen zu stellen, wie bei Autan. Beim Material ist besonders auf Reinheit und neutrale Reaktion der Chemikalien zu achten; von Kalium-hypermanganicum ist nur purum in mittelgrossen Krystallen zu verwenden; crudum ist unbrauchbar. Die beiden Substanzen bürgern sich im Handel mehr und mehr ein. Die Prüfung auf Reinheit bietet keine Schwierigkeiten. Da die Entwickelungsgefässe bedeutend kleiner als bei Autan zu sein brauchen ($\frac{1}{3}$–$\frac{1}{2}$), so dürfte ihre Beschaffung etwas weniger Schwierigkeiten machen; ich halte dünnwandige Blechgefässe (auf Steine oder Holzsplitter gestellt) für am vorteilhaftesten. Besonders, wenn unverbrennbare Sachen zur Unterlage benutzt werden, dürfte allen Anforderungen in bezug auf das Material der Gefässe genügt werden. Holzgefässe sind wegen Feuersgefahr zu vermeiden. Es sind von verschiedenen Seiten Entzündungen der reagierenden Masse beobachtet. Vorsicht ist deshalb immerhin geboten. Wasser darf nie zuletzt und in kleinen Portionen hinzugefügt werden. Lockemann hält Feuersgefahr bei reinem krystallisiertem Kalium-hypermanganicum nicht für möglich. Abdichtung ist selbstverständlich erforderlich.

Mayer glaubt allerdings sie könne mal zur Not fortfallen. Mittlere Wärme der Luft und des Wassers (15°–20° C.) ist möglichst innezuhalten. Bei zu heissem Wasser entsteht allzu rasche und allzu heftige Reaktion. Der Eintritt und Verlauf der Reaktion ist noch mehr wie beim Autan von der vorhandenen Wärme abhängig. Wegen der nicht ganz von der Hand zu weisenden Feuersgefahr lasse ich, wenn möglich, vom Fenster aus nach 5–10 Minuten kontrollieren, ob ein Feuerschein zu sehen ist, m. E. liegen hierzu aus der Praxis noch nicht genügende Erfahrungen vor. Durch genaues Innehalten der Mischvorschrift wird aber wohl jede Feuersgefahr vermieden. Die Einwirkungsdauer soll auch bei diesem Verfahren 5–7 Stunden betragen. Geruchbelästigung ist dieselbe wie bei anderen gutwirkenden Verfahren. Durch Spritzer beschmutzte Gegenstände können durch Natronbisulfit und verdünnte Salzsäure gereinigt werden. Die Pulver sind vollkommen lager- und transportfähig. Der Sicherheit halber wird man für die beiden Pulver nur gut verlötete haltbare Blechkästen mit gelöteter Zwischenwand und kaltbare Papierbeutel verwenden. Schon die gewöhnliche Feuchtigkeit der Luft leitet eine Reaktion ein und schädigt die spätere Ergiebigkeit. In vollständig luftdicht abgeschlossenen Gefässen soll sich das Paraform und Kalium-hypermanganicum nach Lockemann und Croner monatelang unverändert halten. Der Umfang der von

Kalähne und Strunk angegebenen Packung beträgt für je 40 cbm. etwa 15×11×11 cm., das Gewicht etwa 1,700 kg. Abgesehen von grösserer Billigkeit sind nach Kalähne und Strunk die Vorteile dieses Verfahrens dem Autan gegenüber: (1) Die Reaktion tritt meist später auf als bei Autan; (2) bei gleicher Menge Paraform wird die doppelte Menge Formaldehyd- und die 1½fache Menge Wasserdampf erzielt. Die Kosten sind geringer. Die Entwickelungsgefässe brauchen nur ⅓ zu betragen. (Mir scheint ⅓ zu günstig bemessen zu sein.) Dem Formaldehyd-Kalium-hypermanganicum Verfahren gegenüber: (1) Nur feste Materialien (Transporterleichterung); (2) bedeutend kleinere Entwickelungsgefässe nötig; (3) genügend Zeit zum Mischen bis zum Eintritt der Reaktion. Im übrigen fanden alle Autoren bei ihren Untersuchungen befriedigende Desinfektionswirkung: Feuersgefahr ist m. E. nur bei Mischung der Materialien in falscher Reihenfolge vorhanden, z. B. Wasserzusatz zuletzt und portionsweise.

Man darf wohl sagen, das Paraform-Kalium-hypermanganicum-Verfahren ist das beste apparatlose Verfahren was wir haben.

Von andern apparatlosen Verfahren sind noch zu nennen:

1. *Autoform.*—Es wird von Reiherstieg-Hamburg in den Handel gebracht, ist in den meisten Kulturstaaten patentiert und besteht aus Festoform, einem 32 prozentigen Formaldehyd-Seifenpräparat und Kalium-hypermanganicum. Während es von Dörr und Raubitschek sehr gelobt wurde, sprechen sich andere Untersucher vorsichtiger, ja teilweise abfällig aus. Seine Wirksamkeit soll hinter den mit Formalin oder Paraform arbeitenden Verfahren zurückbleiben. Es schäumt stark und bedarf deshalb doppelt so grosser Gefässe wie Autan. Die Ausführung der Desinfektion macht dadurch Schwierigkeiten. Feuergefahr ist nicht vorhanden. Nach Croner und Pauke ist die Zusammensetzung des Festoform eine wechselnde. Es ist sehr viel teurer wie andere apparatlose Verfahren; 40 cbm. berechnen sich auf 4.75 M. Nach Hilgermann kostet eine Desinfektion eines Wagenabteils, II. Klasse, 2.50 M.; III. Klasse, 1.50 M. Grosskonsumenten wird ein Rabatt bis 40 Prozent gewährt. Autoform ist ein Geheimmittel und als solches unkontrollierbar. Nach Croner soll es sich schon nach einigen Monaten zersetzen. Die Blechbüchsen rosten leicht.

2. *Formangan,* der Firma Schneider, Wiesbaden. Nach Schreiber 60 Prozent Formaldehyd in fester Form, seifig, bröcklig, weiss wie Kalk, in Wasser unlöslich; von der Fabrik zurückgezogen.

3. *Formobas, früher Formobor,* genannt ist von Wollberg-Altwasser erfunden und wird von Carvin und Co. in Altona in den Handel gebracht. Es enthält 33.3–38.3 Formaldehyd und 0.25–13 Prozent Borax. Bitter hatte schlechtere Desinfektionswirkung als mit anderen Verfahren, ausserdem ist es 4mal teurer wie das Formalin-Kalium-hypermanganicum-Verfahren.

4. *Aldogen*, ein französisches Präparat von Carteret, welches mit Chlorkalk und Paraform arbeitet. Es bietet keinerlei besondere Vorteile und hat den grossen Nachteil, dass es sehr teuer ist. Eine 20 cbm-Packung kostet 3 fr. = 2.40 M. Nach Böhnke muss die für einen Rauminhalt zu berechnende Menge an Material noch um $\frac{1}{5}$ höher berechnet werden, wie auf den Packungen steht.

5. *Kalkverfahren*, von Huber und Bickel. Es wird folgendermassen beschrieben: In einem 80 l. grossen Holzgefäss werden 3 kg. frischgebrannter Kalk, 9 l. siedend heisses Wasser und 3 l. Formalin vermischt. Von der Firma Beyer & Co. in Elberfeld besteht ein amerikanisches Patent 855,233. Aetznatron und Kalium-hypermanganicum und Paraform-aa und die doppelte Menge Wasser. Statt Aetznatron auch Aetzkali oder die $1\frac{1}{2}$ fache Menge Soda oder Pottasche. Sehr auffallend ist hierbei die grosse Menge Alkali.

Gewissenlosen, marktschreierischen Anpreisungen von Raumdesinfektionsmitteln, denen gar keine oder nicht hinreichende wissenschaftlich begründete Untersuchungen zu Grunde liegen, sollte von wissenschaftlicher Seite stets mit aller Deutlichkeit entgegengetreten werden.

Sehr vielen apparatlosen Verfahren sind zur Ammoniakentwickelung bestimmte Pulver beigegeben: Chlorammonium und Kalkpulver. Ueber die Beseitigung des Formaldehyds durch Ammoniakentwickelung herrschen sehr verschiedene Ansichten. Ich glaube, dass wir im Kriege Ammoniak entbehren können und mit Lüftung der Zimmer auskommen.

Eine andere, gerade für Kriegszwecke wohl sehr wichtige Frage möchte ich hier kurz streifen: Es wird nicht nur von Klinikern, sondern auch von Hygienikern häufig betont, dass die zur Seuchenbekämpfung getroffenen Massnahmen durch Schematisieren zu weit gehende seien und dass die dafür aufgewandten Mittel, Geld, Arbeitszeit, Belästigung des Publikums, beim Militär Beeinträchtigung des Dienstes, dem erzielten Nutzen nicht entsprechen, so z. B. auch die Zimmerdesinfektion. Die Arbeit von Walter aus dem Greifswalder Hygienischen Institut behandelt kritisch diesen Gesenstand, in erster Linie hat auch Flügge hier klärend und anregend gewirkt. Es ist nicht von der Hand zu weisen, dass wir vielfach "Luxusdesinfektionen" treiben. Wenn diese im Frieden nun auch möglich und zu rechtfertigen sind, so sicherlich nicht im Kriege. Gerade dort soll jeder Arzt, besonders der Hygieniker seine Massnahmen auf das Allernotwendigste herabsetzen, denn nur so kann er ein einwandfreies Durchführen des nur wirklich Notwendigen erreichen. Bei jeder erforderlichen Desinfektion im Kriege sollte sparsam mit den Materialien umgegangen werden, und ein Arzt sollte möglichst jedesmal entscheiden, ob und in welcher Weise und Ausdehnung die Desinfektion stattzufinden hat; das darf auf keinen Fall den Desinfektoren überlassen werden, die mehr oder weniger nur schematisch

arbeiten können, und sollen. Als Richtschnur der ärztlichen Anordnungen bei Desinfektionen mögen einige Sätze hier angeführt werden:

1) Bei Infektionskrankheiten, deren Erreger nach Verlassen des menschlichen Körpers sofort oder nach kurzer Zeit zu Grunde gehen, z. B. Genickstarre-, Diphtherie-, Protozoenerkrankungen ist nur in den seltesten Fällen ausser Beseitigung der infektiösen Ausscheidungen und gründlicher, mechanischer Desinfektion, d. h. mit flüssigen Desinfektionsmitteln, eine Raumdesinfektion erforderlich.

2) Räume und Gebäude, welche durch ihre Bauart und Grösse eine genügende Konzentration des Formaldehyds während der zur Keimtötung notwendigen Zeit nicht gewährleisten, sollen nur mechanisch desinfiziert und dabei gründlich gereinigt werden. In Betracht kommen hier Kirchen, Scheunen, meist auch Wellblechbaracken und andere zu grosse Räume, besonders auch alle Gebäude, die nicht hinreichend abgedichtet werden können.

3) Stets ist auf die sogenannte mechanische Desinfektion und spätere Reinigung das grösste Gewicht zu legen. Sie ist auf keinen Fall, weil Raumdesinfektion stattgefunden hat, zu unterlassen; oft genügt sie allein.

4) Die Raumdesinfektion ist stets nur als ein Glied in der Reihe der Massnahmen zur Seuchenbekämpfung anzusehen.

Am Schluss meiner Ausführungen möchte ich nochmals hervorheben, dass ich das Paraform-Kalium-hypermanganicum-Verfahren für das beste, bisher bekannte apparatlose Formaldehyd-Raumdesinfektionsverfahren, auch für die Verwendung beim Heere im Kriege, halte. Aber wie überhaupt das Formaldehyd mit seiner geringen Tiefenwirkung und ungenügenden Desinfektionskraft auf Tuberkelbazillen und sporenhaltige Bazillen sehr viel zu wünschen übrig lässt, so auch dieses Verfahren. Von einer idealen Raumdesinfektion sind wir noch weit entfernt.

SCHLUSSSÄTZE.

Nachteile der Verfahren mit Apparaten zur Formaldehyd-Raumdesinfektion:

1) Anschaffungs- und Reparaturkosten; bei dem sonst sparsameren Materialverbrauch wenig wichtig.

2) Reparaturen nur von sachkundiger Hand ausführbar.

3) Apparate nebst den dazu gehörigen Flüssigkeiten schwer transportfähig.

4) Die Zahl der gleichzeitig auszuführenden Desinfektionen ist von der Zahl der Apparate abhängig.

5) Relative schwierige und langwierige Bedienung der Apparate.

Von den apparatlosen Verfahren haben sich eingebürgert:

1) Das Formalin-Kalium-hypermanganicum-Verfahren.
2) Das Autan.
3) Das Paraform-Kalium-hypermanganicum-Verfahren.
4) Weniger das Autoform.

Die anderen Methoden sind entweder zu teuer oder desinfizieren nicht hinreichend. Die drei zuerst genannten Verfahren unterscheiden sich besonders in folgenden Punkten:

1) In der desinfizierenden wie auch Tiefenwirkung übertreffen die beiden mit Kalium-hypermanganicum arbeitenden Verfahren das Autan. Bei ungünstigen Bedingungen Erhöhung der Materialmengen erforderlich. Eine einheitliche, möglichst einfache Prüfungstechnick der Raumdesinfektionen für Laboratorium und besonders für die Praxis, die es ermöglicht, jede Desinfektion einwandfrei in ihrer keimtötenden Wirkung nachzuprüfen, ist wünschenswert und anzustreben.

2) Inbezug auf Anforderungen an das Personal (Vorbildung, Arbeitszeit) unterscheiden sich die drei Verfahren nicht.

3) Wegen seines hohen Preises wird Autan wohl nur dort, wo es häufig verlangt wird, vorrätig gehalten werden; ausserdem ist es als Geheimmittel unkontrollierbar; bei den beiden anderen Verfahren leicht ausführbare Kontrolle auf Reinheit.

4) Bei Autan ist ganz besonders auf schlechtleitende, dünnwandige Gefässe zu achten. Bei den beiden anderen Verfahren ist Holz zu vermeiden. Am besten sind dünnwandige, auf Steine gestellte Blechgefässe.

5) Bei Autan besteht keine Entzündungsgefahr. Bei den beiden anderen Verfahren nur bei Mischung in falscher Reihenfolge, besonders wenn Wasser zuletzt und in kleinen Mengen, zu heiss und ohne genügendes Umrühren zugesetzt wird. Lockemann hält Feuersgefahr nur bei chemisch unreinen Materialien für möglich.

6) Innehalten einer mittleren Temperatur der Luft (10–15° C.) und des Wassers (15°–20° C.) ist wünschenswert, besonders bei den Verfahren mit Kalium-hypermanganicum; ebenfalls eine bestimmte Wassermenge; bei zu wenig Wasser keine genügende Sättigung der Luft mit Feuchtigkeit, bei zu viel Wasser, Entstehung von Formalin durch Lösung des gebildeten Formaldehyds im Entwickelungsgefäss.

7) Belästigung der Bewohner inbezug auf Geruch und Sachbeschädigung, bei keinem der drei Verfahren in nennenswertem Masse.

8) Abdichtung des Zimmers und Ausbreitung der Gegenstände bei allen Verfahren gleichmässig nötig.

9) Notwendige Dauer der Gaseinwirkung bei allen Verfahren 5–7 Stunden erforderlich.

10) Inbezug auf Gewicht und Umfang belästigen die Paraform-Kalium-hypermanganicum-Packungen am wenigsten

11) Autan ist erheblich teurer wie die beiden anderen Verfahren.

12) Die Transport- und Lagerfähigkeit hängt von der Verpackungsart der Materialien ab. Formalin bietet wegen Zerbrechlichkeit der Gefässe am meisten Transportschwierigkeiten.

13) Beseitigung des Formaldehydgeruches durch Ammoniak ist wünschenswert, aber nicht unbedingt notwendig, wenigstens nicht für den Kriegsfall.

14) Ueberflüssige, sogenannte "Luxusdesinfektionen" sind im Kriege zu vermeiden.

15) Apparatlose Verfahren müssen schon im Frieden bei jedem Desinfektorenunterricht gelehrt werden. Wiederholung etwa alle drei Jahre notwendig.

16) Von allen apparatlosen Formaldehyd-Raumdesinfektionsmethoden muss dem Paraform-Kalium-hypermanganicum-Verfahren der Vorzug gegeben werden.

ÜBERSICHT ÜBER DEN GANG DER NACHPRÜFUNG EINES FORMALDEHYD-RAUMDESINFEKTIONSVERFAHRENS.

1) Absterben der Krankheitserreger in einer bestimmten Zeit.
2) Gewisse Tiefenwirkung.
3) Leichte und sichere Herstellung des desinfizierenden Gases:
   a) Anforderungen an die Zahl und Ausbildung des Personals.
   b) Anforderungen an das Material: (1) Leichte Erhältlichkeit der Substanzen im Handel; (2) leichte Dosierbarkeit des Materials; (3) gleichmässige Güte der Handelsware und leichte Kontrollierbarkeit derselben.
   c) Beschaffung der notwendigen Geräte.
   d) Gefahrlosigkeit, besonders inbezug auf Feuergefährlichkeit.
4) Die übrige Ausführung der Desinfektion: (a) Abdichtung, (b) Luftwärme, (c) Wärme der Entwickelungsmasse, (d) Ueberwachung, (e) Zeiterfordernis.
5) Geringe Belästigung der Bewohner: (a) Dauer der Desinfektion, (b) Geruchbelästigung, (c) Beschädigung von Gegenständen durch Ueberschäumen und Umherspritzen des Materials während der Reaktion.
6) Preis des Verfahrens (ferner für militärische besonders Kriegszwecke).
7) Transport- und Lagerfähigkeit des Materials: (a) Gewicht, (b) Umfang, Grösse und Form der Gefässe, (c) Haltbarkeit des Materials, (d) Widerstandsfähigkeit der Packungen gegen: (1) Witterungseinflüsse, Feuchtigkeit, Trockenheit-Wärme, Kälte; (2) Erschütterungen.

Preis-Uebersicht über Formaldehyd-Raumdesinfektionsverfahren mit und ohne Apparate für 100 cbm. Rauminhalt in Mark.

	Preis nach—					
	Angerer, 1906.	Lösener, Desinfektion Prozent auf 110 cbm. berechnet.	Hoffmann, Deutsch militärärztliche Zeitschrift, 1908.	Böhnke, Zeitschrift für Hygiene, Bd. 67.	Croner, Zeitschrift für ärztliche Fortbildung, 1910.	Fabrik-Preise.
Breslauer Apparat	1.90	4.03	2.39	.....	.....	.....
Berolina Apparat	2.36	.....	2.60	.....	3.10	.....
Colonia Apparat	1.20	.....	1.89	.....	5.10	.....
Lingner Apparat	2.20	.....	2.57	.....	.....	.....
Formalin-Kalium hypermanganicum, 3.1 auf 1 cbm	.....	3.97	.....	5.40	.....	.....
Formalin-Kalium hypermanganicum, 5 auf 1 cbm	.....	6.07	.....	8.50	15.20	.....
Autan (ohne Gewähr einer bestimmten Menge Formaldehyd auf 1 cbm	.....	8.40	.....	8.40	.....	8.40
Paraform-Kalium hypermanganicum	.....	.....	.....	7–7.30	.....	.....
Festoform-Kalium hypermanganicum, 3.1 auf 1 cbm	.....	[1] 7.55	.....	.....	.....	.....
Festoform-Kalium hypermanganicum, 5 auf 1 cbm	.....	[2] 10.32	.....	.....	.....	.....
Autoform, 3.1 auf 1 cbm	.....	8.10	.....	.....	7.20	.....
Autoform, 5 auf 1 cbm	.....	13.20	.....	.....	10.80	.....
Paragan	.....	.....	.....	.....	.....	7.90
Formangan	.....	.....	.....	7.50	.....	.....
Aldogen	.....	.....	.....	16.00	.....	.....

[1] 5.35 Prozent. [2] 8.47 Prozent.

Offizieller Bericht der III. Landesversammlung des Bayerischen Medizinalbeamten-Vereins. Einschliesslich 1 M. für jede Benutzung zur Amortisation des Apparates.

Die der umseitigen Berechnung zu Grunde liegenden Materialienpreise in Mark.

Preis für—	Preis nach—			Fabrik Preise.	Bemerkungen.
	Angerer, 100 l.	Lösener, 100 kg.	Hoffman, 100 l.		
Formalin	100	75	105	120	.....
Paraform	.....	.....	.....	450	.....
Kalium-hypermanganicum	.....	78	.....	95	.....
Spiritus	40	137	35	.....	.....
Ammoniak	40	30	40	.....	.....
Festoform	.....	[1] 240	.....	.....	.....

[1] 144 Prozent.

PERSONAL HYGIENE IN THE FIELD, INCLUDING THE DISINFECTION OF CLOTHING AND EQUIPMENT WITH AND WITHOUT APPARATUS.

Col. Valery Havard, United States Army.

Personal hygiene in the field means the practice of all those habits which tend to safeguard one's self and others from disease, infectious or otherwise. Hygienic habits, once formed, should be observed in all conditions and situations of life, so far as means and circumstances permit, but the soldier, in particular, must be made to realize their

value, not only for his own sake and that of his comrades, but also for the sake of the fighting organization of which he is a part. An efficient and reliable soldier is an expensive product, the result of long and special training and must be preserved from all deteriorating influences, for it is doubtless true that a well-instructed veteran is at least the equal of two recruits and much more economical.

The sanitary condition of troops in the field varies widely according to circumstances. It may approximate perfection in camps of maneuvers or of instruction, formed on selected sites with all conveniences at hand, or it may be very bad, as when marching and bivouacking in presence of the enemy, where considerations of hygiene must be sacrificed to military exigencies. It is precisely in these trying circumstances that the trained soldier shows his knowledge, judgment and experience in taking advantage of every opportunity to secure personal cleanliness, good drinking water, suitable clothing, and avoid all unnecessary exposure to injurious influences.

In this short paper I propose chiefly to review the hygiene of the soldier during actual warfare, when the usual appliances of permanent camps are absent.

Personal hygiene in the field includes, first, personal cleanliness. Reasonably pure water is the most essential sanitary requisite of troops in campaign; its presence or absence makes all the difference between excellent and bad health conditions. A clear running stream, draining an uninhabited watershed, is ideal but seldom available. Springs and wells will generally have to be utilized. If time permits and the material is at hand chemical and bacteriological tests should always be made, but in many situations this can not be done, nor is it always important; external indications, when viewed by an experienced medical officer, will often enable him to decide whether contamination is probable or not, and which of several procurable supplies should be preferred. In case of doubt, water must always be subjected to one or the other of the several simple and practical methods of purification. Boiling is effective but demands fuel, suitable utensils, and time; furthermore, the water must be cooled and thoroughly aerated to be palatable. Mere sedimentation, with or without alum, will carry down a large proportion of the bacteria and organic matter in suspension. Sedimentation, followed by rapid filtration through cloths, as in the Darnall filter, has been proved efficient. Probably the most satisfactory system of water purification, in the absence of special appliances, is by means of chloride of lime or bleaching powder, in the proportion of a pound to 100,000 gallons of water.

Great care must be taken to prevent the contamination of water supplies, especially of that used for drinking purposes, and when the available amount is not abundant strict economy should be insisted

upon. In this as in other matters the American soldier is very much in need of warning as to the necessity of husbanding his resources in the field. He must be taught that, when required, he can get along without discomfort with 1 or 2 gallons of water a day, exclusive of what is used in cooking. The ideal soldier's bath, that is, the cold shower bath, will seldom be possible, but body cleanliness can be obtained by the sponge bath or, if water be too scant, by the use of a wash cloth.

Since the soldier's efficiency depends fully as much upon his feet as upon his rifle, he should devote at least as much care upon them as upon his face or any other part of the body. Feet washed in cold water every day, or whenever opportunities permit, will never suffer from hard marching, provided, of course, they are shod with well-fitting shoes and protected by dry and clean socks. The normal marching equipment, as wisely provided, includes a pair of spare shoes and one of socks. It is good policy for the soldier to change his footgear every few days, if not every day.

The toilet articles carried in the marching equipment consist of a towel, one piece of soap, comb, and toothbrush. To this might well be added a wash cloth, a negligible quantity as to weight but in many situations a good substitute for the sponge. The toothbrush, if left unprotected, is liable to gather all sorts of dirt and to become a source of danger. It should be kept in a long and narrow bottle closed with a cork into which the handle is tightly fitted, the cork permanently remaining on the handle. If the bottle be an inch or so longer than the brush, room is thus provided for a supply of tooth powder.

The "surplus kit" in our service contains one undershirt and one pair drawers, so that whenever the baggage train gets in touch with the soldier he is able to change his underwear. Such change is desirable as frequently as possible, not only to secure all the advantages of a clean skin but also to prevent vermin infestation, especially of the loathsome and dangerous lice, fleas, and bedbugs. A search for these animals should always be made upon removal of underwear and shirt. Clean garments put on before going into battle have also the distinct advantage of reducing to a minimum the chances of infection following gunshot wounds.

While in presence of the enemy the troops are extended into a thin line so that the camp diseases which formerly, from the result of crowding, spread with terrible and relentless intensity, are now much less to be feared. But under the best conditions, contact from man to man in camps and bivouacs, or in trenches, is inevitable and involves special danger of disease transmission; hence the importance of personal hygiene under all conditions of service, so that soldiers may be free from communicable diseases or else, if affected by any of them, may at once seek relief and avoid contaminating others.

The use in common of toilet articles, as well as of meat cans, knives, forks, and spoons, not rare among the men of the same squad or tent, is repugnant, distinctly insanitary, and should be strictly forbidden. The men most likely to borrow these and other articles from comrades are generally careless, unclean individuals and the most liable to transmit infection. Under all circumstances in the field the soldier should have the use of an individual drinking cup; this problem is happily solved, in our new equipment, by fitting a cup to the bottom of the canteen so that it becomes part of the latter and is always carried with it.

A very objectionable and dangerous habit, only too prevalent in this country, is that of promiscuous expectoration. A soldier who is strictly required to use spittoons in barracks and other buildings while in garrison, will be more likely to submit to some restraint while in camp and abstain from ejecting his sputum on the floor of his tent, of the mess tent, or wherever he happens to be. Such disgusting habit involves too much danger to be countenanced or left unrebuked.

During a campaign the hair and beard are liable to become neglected and to grow to unusual length, affording a favorable nidus for vermin and skin parasites. They should be trimmed down, frequently combed, and washed.

Until and including the Crimean War (1859), typhus fever was the greatest scourge of armies in the field. The recent discovery of its transmission by lice renders it easily and completely preventable. It also throws a side light on the dreadful sanitary condition which must have then prevailed. Of camp diseases now most apprehended must be counted those whose germs are contained in the intestinal and renal excretions and voided in latrines, especially typhoid fever, cholera, dysentery, and diarrhea. During a campaign the latrines will consist of shallow and narrow trenches over which the men squat, or of pits of variable depth, the men sitting on a log placed lengthwise over them. Their disinfection will be effected by burning straw or grass on the surface of the contents, or else throwing earth upon the latter. From such latrines flies can not be entirely excluded, and the soiling of shoes, clothing, and hands with excreta is almost impossible to avoid. Even the careful policing of latrines, as well as cleanly personal habits on the part of those using them, although efficacious in checking the dissemination of the above diseases, will not always prevent them. The use of toilet paper must be insisted upon if at hand, but we can easily realize situations where not only tissue paper but paper of any kind may be difficult if not impossible to procure. Besides, the use of paper does not entirely remove the chances of germ transmission; unless the man who suffers from loose bowels has a liberal supply of it and uses it carefully, there is a strong probability that the hand employed in the operation will not completely

escape contamination, although the evidence of this may not be obvious. Furthermore, paper, even the best kind, is far from being an unmitigated blessing when open pits or trenches have to be used; unless great care be taken, the chances are even that, after it has served its purpose, the wind will blow it away and scatter it on the camp grounds.

All military hygienists agree upon the principle that soldiers should wash their hands after defecating and before meals. But it is evident that, in the course of a campaign, such requirement can not always be carried out, or only very imperfectly. There is seldom, however, any good reason why a soldier, unless actually engaged on the firing line, should not always wash his hands at least twice a day, say in the morning before breakfast and at noon before dinner. This is the minimum requirement which will afford a reasonable degree of safety. Such washing is much more effective if done in running water.

So long as troops are marching and engaged in active operations, sickness is rare; it is much more likely to develop when they settle into camp life and are supplied with abundant food, including miscellaneous articles obtained from the surrounding country. There is then a strong temptation to overeat, especially of prohibited dishes, with danger of auto-intoxication and gastro-intestinal troubles. This danger is particularly great in our service on account of the very generous ration allowed, a ration distinctly above the needs of the soldier during the comparative idleness of camp life, and on account of the liberal pay received, which permits him, if not closely watched, to procure attractive but unwholesome articles of food from outside sources. Auto-intoxication from by-products of imperfect metabolism and incomplete elimination, as well as febrile disorders resulting from the ingestion of bacilli of the paratyphoid group, were manifestly among the chief causes which disabled our Army in Santiago de Cuba in 1898, at the close of the campaign. This danger is best averted by keeping down the meat ration so that it shall never exceed one pound a day, providing forms of active exercise and regulating the bowels. The importance of preventing or overcoming constipation, generally a common condition among soldiers and the possible cause of various other ailments, must always be borne in mind.

It is well to note, in this connection, that before going into a fight the soldier will do well to empty his bowels and bladder, and avoid eating a full meal in order to reduce the danger of extravasation and infection in case of gunshot wound.

In the course of active operations the soldier will seldom have the benefit of a cot to sleep on. He is supposed to have a poncho to separate him from the ground and a blanket to place above or beneath him. In most places he will be able to improvise a more comfortable couch, even if only made of grass or brush, and if the camp

is to last a few days, he should raise it up as high above the ground as possible; this, because the stratum of air in contact with the soil is always contaminated with a high percentage of carbon dioxid and other gases of organic fermentation, and because it is liable to be damp. Bedclothes dragging on the ground are also more likely to collect vermin and soil microbes and to harbor objectionable insects.

Of all insects, mosquitoes are the most annoying and dangerous. In an infested camp, measures should be taken to abolish breeding pools by drainage or petrolization, but as long as mosquitoes are present, screens and nets must be used so as to entirely protect the body during the night. The mosquito net, therefore, should always be part of the soldier's equipment.

DISINFECTION.

Disinfection in the field may be required at any time, and medical officers must be prepared for it so far as existing conditions permit. It is a subject calling for judgment and ingenuity, since special apparatus will seldom be available. It can be assumed that any properly organized body of troops in a campaign will have the service of a special hospital, infirmary, or station where contagious cases can be removed and isolated. The prompt separation of such patients from their companies, before they have had time to infect comrades, is one of the fundamental laws of military sanitation. Our Manual for the Medical Department does not provide for any disinfecting apparatus in the field. It seems desirable that one or more of the base hospitals should be supplied with a medium-sized steam and formaldehyde disinfector, mounted on wheels, so that it might be readily taken to wherever needed.

In any case of contagious disease, the patient's effects, namely, his bedding, clothing and equipment, should be sent with him to the hospital, having first, if practicable, undergone a primary treatment at the place of infection. In this way only can loss of personal property be guarded against, besides insuring a greater degree of safety. Bulky and heavy articles, such as tents, cots, tables, chairs, boxes, etc., had better be disinfected in loco.

In the absence of apparatus and chemical disinfectants we must have recourse to natural physical agents, namely, heat (solar and artificial), light, airing, and washing. Fire is our most potent disinfectant, but only to be used when other means are inadequate. Thus, in cases of plague, cholera, or smallpox the sacrifice of a few mattresses and pillows may be the best course to adopt. Simple washing with soap, in running water, or exposure to a heavy rain, will remove most of the dangerous germs from an infected fabric. Hot water and soap will do so still more successfully. The effect of

washing can be supplemented and perfected by exposure to nature's great purifiers, the sun and atmospheric oxygen. The direct rays of the sun may be relied upon to destroy practically all pathogenic bacteria withing a few hours. They are especially effective to disinfect polluted soil, for instance, the soil of tents in which infectious diseases have occurred. Boiling, however, is the readiest and most efficient method, provided suitable kettles and fuel are available and the nature of the contaminated articles permit.

Excreta, such as fecal matter, urine, sputum, should be burned or mixed with lime and buried.

In our service the only chemical disinfectant provided for use at the front is what is found in the medical and surgical chests, namely, in each, one tin containing 350 antiseptic tablets (Hyd. chl. corros.). In addition to this, field hospitals are supplied with a few bottles of chlorinated lime. It is presumed that in case of a serious outbreak of infectious disease in any brigade or division a sufficiency of the above disinfectants could be obtained from reserve supplies in rear. In most places it will be also possible to procure quicklime, from which fresh milk of lime can be prepared as needed.

Let us suppose a soldier, especially if recently returned from a visit to relatives and friends, shows symptoms indicative of an infectious disease, such as cholera, typhoid fever, smallpox, or measles. It will be the duty of the noncommissioned officer who first becomes aware of it to report the case at once to the company commander, so that the suspected man may be examined by a medical officer and, if the suspicion be confirmed, separated from his comrades and taken to the hospital or infirmary without delay. His mates are also removed to an isolation tent or room and kept in quarantine and under observation until the nature of the disease is determined. The vacated tent is closed up and guarded. Should the disease prove of an infectious character, the tent and all its contents must undergo disinfection and the patient's mates be treated as suspects—that is, kept in quarantine for a period of days at least equal to that of the incubation of the disease. Some excellent authorities contend that such "terminal" disinfection of the tent is not necessary beyond thorough airing and sunning, and that the danger is removed with the patient himself. Although there is a strong trend of modern medical opinion in that direction, it seems best, in the present state of our knowledge, not to neglect the usual simple measures generally available under the circumstances.

The tent should be turned inside out, scrubbed with a solution of bichloride (1 to 2,000), and then exposed to sun and wind. The ground area which it covered is strewn with straw or hay (sprinkled with coal oil, if at hand) and fired. Bedding and clothing are boiled

15 minutes in a kettle; the furniture and equipment are scrubbed with hot water and soap or with a solution of bichloride and then dried in the sun.

Milk of lime, when available, can be used to disinfect feces and urine, sinks, stagnant pools, polluted soils, etc. The chlorinated lime supplied by the field hospitals is a stronger and more reliable disinfectant. It is also an excellent purifier of water for drinking, washing and bathing purposes.

Whenever a disinfecting apparatus is deemed desirable and the chemicals are available, the easiest one to improvise is the formaldehyde chest—that is to say, a box constructed of tongued-and-grooved boards, about 6 feet in length, width and height, and with only one opening, to serve as door. A tarpaulin or tent fly should be fitted over it to prevent leakage. The gas may be generated by the action of potassium permanganate in the proportion of 1 pound of formalin, 1 pound of potassium permanganate, and half a pound of water for each 1,000 cubic feet of space. In this box should be disinfected preferably those articles which can not be boiled in water without damaging them, such as blankets, outer clothes, articles of fur, leather, rubber, and felt. Mattresses and pillows should be opened and the contents exposed.

Field hospitals may not transport relatively bulky and heavy articles like formalin and potassium permanganate, but could easily carry a bottle or two of trioxymethylene (paraform-aldehyde), a white powder of good keeping qualities, and giving off, when volatilized, its own weight of gas. It would seem to afford the easiest and most efficient way to generate formaldehyde in the field.

For most purposes flowing steam is superior to formaldehyde gas, possessing much greater penetrating power. To improvise a small steam chest and generator in the field is a difficult problem but, as shown by Col. A. R. Aldridge, R. A. M. C., not an impossible one when conditions are favorable—that is, when the material is at hand and an experienced mechanic available.

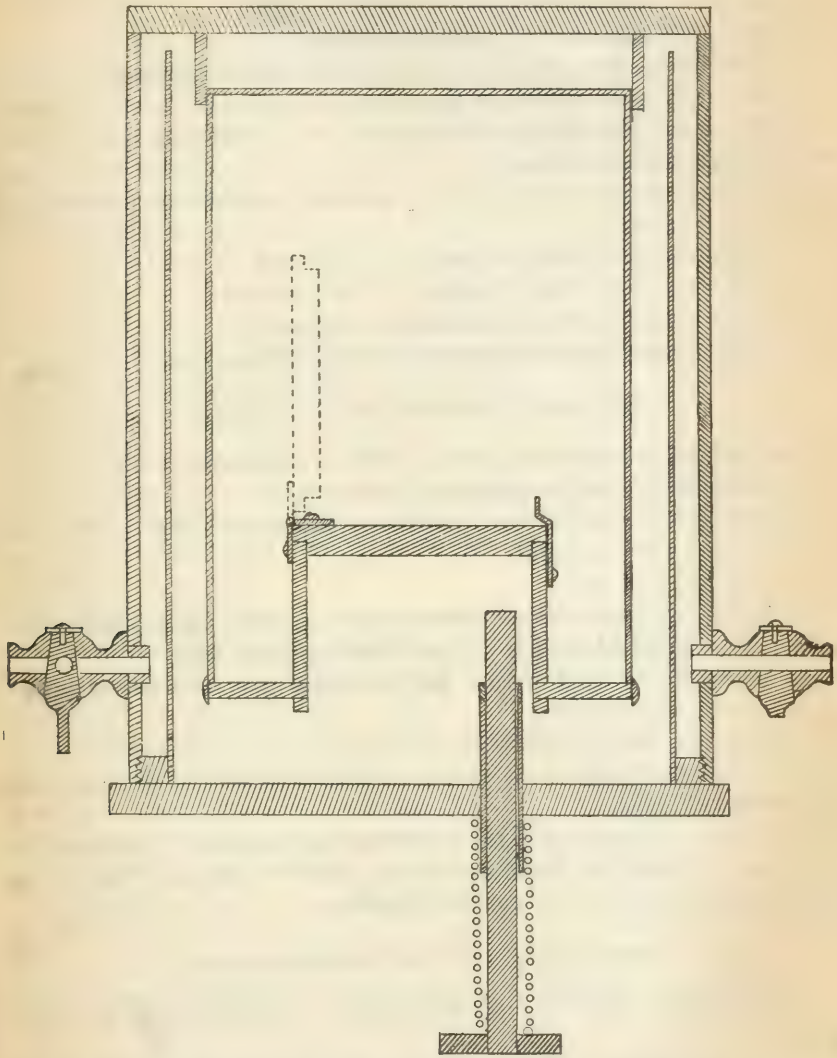
GASEOUS DISINFECTION OF EQUIPMENT IN THE FIELD.

EDWARD L. MUNSON, A. M., M. D., Major, Medical Corps, United States Army.

I present herewith an original method, and an original apparatus, of simple, light, compact, and inexpensive character, by which disinfection of the equipment of the soldier in the field may be accomplished by gaseous disinfection in as short a time as 20 minutes, and the destruction of insects, vermin, and parasites thereon, heretofore impracticable with the same agents, within half that time.

When the above subject was assigned me it seemed desirable to inquire whether its present recognized difficulties could not be overcome, and in what manner. It was also thought that the present

gaseous disinfectants of recognized efficiency should prove sufficient for all purposes, and that the problem lay in their adaptation to such conditions of concentration and control as should materially enhance their germicidal qualities. On investigation it soon became evident that the solution of this problem nad two parts; one relating



to a suitable generator for developing and delivering a pure gas, and the other to a container in which the latter should be applied in as concentrated a form as possible to the articles to be disinfected. A very considerable amount of thought and mechanical, chemical, and bacteriological experimentation was necessary before reaching the very satisfactory results first mentioned.

THE IDEAL GENERATOR.

The requirements of the ideal generator for gaseous disinfection would seem to be:

1. Use of a germicidal gas which can be handled without danger to the operator.
2. Compactness, portability, and little weight.
3. Strength, with little liability to injury.
4. Few parts, with simplicity of operation and cleansing.
5. Freedom from danger of fire or scorching.
6. Freedom from danger of explosion, or the blowing over of substances harmful to fabrics.
7. Ability to be used inside or outside a disinfecting container, whatever its size.
8. Sufficient generating capacity for the work at hand.
9. Delivery of gas under control of the operator.
10. Short-time factor for developing the gas.
11. Short-time factor for accomplishing disinfection.

THE IDEAL DISINFECTING CONTAINER.

The general requirements of the above would seem to be:

1. Portability, compactness, and little weight.
2. Sufficient strength, and sufficient impermeability to the gas used, for the work in hand.
3. Simplicity of use.
4. Ability to improvise or procure the necessary materials without difficulty in the field, and to utilize them without delay.
5. Ability to be used with a gas generator operated either within or without such container.
6. Sufficient size for the work in hand.
7. Cheapness, so as to be used if desired as a packet container for disinfected articles.
8. Ability to reduce to the minimum the amount of residual air otherwise diluting the disinfectant gas, with the purpose, but not on the same principle, of the vacuum chamber.

THE IDEAL GASEOUS DISINFECTANT.

Formaldehyde gas was chosen from its well-known excellent qualities.

This gas was regarded as in many ways very superior to sulphur dioxide; but as some might prefer to use the latter, it was borne in mind that the generator should be capable, with slight modification, of handling it. It was also thought desirable, if a highly poisonous gas should be preferred as an insecticide, as hydrocyanic acid, that

the generator should likewise be capable, without change, of safely developing it.

The more flexible the use of the apparatus, under the difficulties of supply in the field, and the greater the number of chemical substances it could utilize in emergency, the greater its practical utility.

The ordinary method of generating formaldehyde, by mixing formalin and potassium permanganate in an open vessel, is a simple, easy, and excellent way of generating this gas for purposes of disinfection. Unfortunately, it is only applicable to a limited field of usefulness—as in the disinfection of rooms which can be entered while the reagents are mixed by hand. There is also much spattering of the reagents from the violence of the reaction, which must be provided against to prevent staining of articles in the vicinity.

THE GAS GENERATOR.

Several experimental generators were made. In its final simplified form, as made for me by the Kny-Scheerer Co., of New York, it is a cylindrical apparatus which may be made in any convenient size. The material is preferably copper or brass by reason of their conductivity of heat. As little material is used as is consistent with proper strength of the apparatus, since the operation of the latter depends upon chemically generated heat, and the heating of an unnecessary amount of cold metal greatly interferes with its efficiency and is wasteful of chemicals.

The apparatus consists of but four parts, all extremely simple, solidly built and not liable to injury, viz. (*a*) an outer container, (*b*) a cover and gas bell, (*c*) a mixing can to hold liquid chemicals, and (*d*) a dosing box to hold solid chemicals.

The outer container.—This is a simple cylinder, having a solid bottom and a cap held in position with thumbscrews. It is perforated at two equidistant points near the top, into each of which is screwed a short tube. One of these tubes is provided with a turncock, so that the flow of gas through it may be turned on or off as desired.

When the apparatus is used inside a container, this tube is opened to permit of more ready escape of gas; if used outside of a container it is closed and the gas forced to pass through the other outlet. The latter is left permanently open without a turncock, to allow escape of gas at all times, so that no explosion can occur through confinement of the gas by inadvertence on the part of the operator. When the apparatus is used outside of a disinfecting space, the gas is discharged through this tube and through a rubber tube fitted over it into such space.

The cover and gas bell.—This is a top, with tight gasket on its lower rim, held in position with thumbscrews so as to produce a gas-tight joint.

The top (of the cap) is perforated to receive a plunger which is ground to make a tight joint, and has further a rubber-guarded shoulder fitting snugly against the bottom of the cap and also held up strongly by a spring. Gas pressure inside makes the plunger joint tighter by forcing this shoulder with its rubber gasket against the rim. Pressure on top of this plunger operates to open the dosing box and discharge the contents of the latter into the mixing can.

From the under part of the cap there projects a cylinder which reaches down to within half an inch of the bottom of the container and extends laterally to within about a quarter of an inch of the outer container on all sides. This forms a gas bell which is necessary to prevent spattering; any chemicals harmful to fabrics, as manganese hydroxide, thrown out of the mixing can in the violent reaction which occurs, are caught by this gas bell and carried down to the bottom of the outer container, where they are below the current of escaping gas and are thus not again thrown upward. This gas bell insures that, with the maximum charge for which the apparatus is intended, nothing can pass over except gas and water vapor; and danger of discoloration of articles under sterilization, by either unoxidized potassium permanganate or manganese hydroxide, is thus absolutely avoided. The construction is such that even if the apparatus be tipped over, no solid or liquid chemicals can pass out.

The mixing can.—This is a simple cylinder with a tight bottom, reaching in height to about an inch of the cover, and in external diameter extending on all sides to within about a quarter of an inch of the cylinder forming the gas bell just mentioned.

This cylinder sits on a frame which raises it about three-eighths of an inch above the bottom of the outer container. The air space thus made is desirable in order to allow free movement of gas under and around the mixing can and to prevent overheating of the outside container.

The lug attached to this mixing can is intended to fit in a socket attached to the frame of the bottom of the outer container, so that the same relation within the apparatus will always be maintained on assembling the parts.

The upper rim of the mixing can is cut away into three grooves 90° apart, which receive three corresponding shouldered arms extending from the dosing box. A perforated shoulder on the mixing can, in the remaining quadrant, receives a plain arm on the dosing box. The latter must thus always be put in the same relation to the mixing can, and the latter to the outer container.

The dosing box.—This is a metal box, supported at its upper rim by the four arms above mentioned. It is suspended within the mixing can, its upper margin flush with the rim of the latter.

The bottom of the dosing box is hinged, a spring catch opposite the hinge holding this bottom up firmly. The plunger, already referred to as passing through the cover, when pressed down strikes against the spring of the dosing box in such a way as to press it back, let the bottom fall, and discharge the contents of the dosing box into the mixing can.

To assemble, charge, and operate the apparatus, (*a*) the legs of the mixing can are set in the sockets of the outer container; (*b*) the desired amount of formalin is measured off and poured into the mixing can; (*c*) the amount of permanganate of potash necessary to best react with the amount of formalin used is measured and put in the dosing box (ordinarily the dosing box is evenly filled with the permanganate, and formalin is poured into the mixing can until the mark on its inside is reached); (*d*) the dosing box is put in its proper position on the mixing can; (*e*) the cover is clamped into position; (*f*) the generator is put in the gas bag or other container and sealed in if to be operated inside, or connected with it by a rubber tube if to be operated from outside; (*g*) the plunger is pressed down, mixing the chemicals and starting the reaction.

It is clear that this simple operation presents no difficulties to even the least intelligent. Mistakes are practically impossible.

THE EXPANSIBLE CONTAINER FOR ARTICLES TO BE DISINFECTED.

In order to secure the benefit of a gas for disinfection, it must be confined, if not wholly, at least to a material degree. Further, it is important that it should not be diluted with air any more than can be avoided. This is accomplished for the present apparatus as follows:

(A) By making an impermeable gas bag out of ordinary rubber sheeting. This, as furnished by the Medical Department, comes in rolls 54 inches wide. A strip 6 feet long folded on itself makes a bag 54 by 36 inches, which is able to hold the complete clothing, blankets, and equipment of two soldiers, together with the disinfecting apparatus. Any holes or cracks in the rubber are effectively sealed with small strips of zinc-oxide plaster applied hot. The edges may be stitched or pinned together for greater strength. The free edges are usually thus fastened on the two sides and the third open side for about half its length, leaving a permanent opening about 2 feet long, through which articles may be passed.

In making the bag the rubber surface is turned outside, with the cloth fabric on the inside. This is important, for the reason that formaldehyde seems to combine with fresh rubber to a considerable extent, thus materially reducing the strength and disinfectant power of the contained gas in the first few experiments with such a gas bag.

The seams of the bag are made permanently gas-tight by strips of ordinary zinc-oxide plaster, as supplied by the Medical Department,

about 2 inches wide and passed over the edges of the rubber sheeting, so that these come about in the middle of this plaster strip. The latter is applied hot and pressed smoothly and firmly into place. The resulting seam is absolutely gas-tight. Such a bag takes only a few moments to improvise.

After putting the articles and disinfecting apparatus inside the bag through the permanent opening the edges of the latter are held together and a tight joint quickly made with a suitable strip of zinc-oxide plaster. This same plaster strip can be used for several disinfections without renewal.

If the generator be used outside the bag, a glass or metal tube used to deliver the gas inside the bag is run through a hole in the strip of zinc-oxide plaster. On blowing the bag full of gas and disconnecting the generator the tube may be withdrawn and the hole quickly closed by pressing the plaster together, or it may be left in position and have plaster stuck over its open end.

The rubber blankets forming part of the equipment of field and evacuation hospitals may be similarly used, or special rubber bags made for the purpose may be employed.

Large amounts of formaldehyde can be generated in such a bag in a room without the slighest odor. As there is no loss of the gas through its escape, the generation of smaller amounts than are required in ordinary disinfection work would be equally effective.

(B) A similar impermeable gas bag can be quickly made of the soldier's poncho by sealing up the slit for the head and the several grommet holes with zinc-oxide plaster.

It is not necessary to stitch or fasten the edges of the poncho together, as the plaster holds firmly and the gas pressure inside is not sufficient to rupture or force it from its position. After use the bag can be promptly pulled apart and the poncho returned to its original function.

This poncho bag is 64 by 44 inches and will hold the equipment of three soldiers.

(C) By the use of ordinary paper bags, such as are supplied by the Subsistence Department or are available in any community. If necessary, suitable bags can be quickly made of any size out of ordinary wrapping paper and flour paste or the use of zinc-oxide plaster to form the seams.

The ordinary commercial 100-pound paper bag will hold all the clothing of the soldier, together with either his blanket or overcoat. It will not hold both of the latter in addition.

But there are many larger bags on the market for other purposes, as, for example, the "moth-proof clothing bag." A cylindrical paper bag 30 by 60 inches when folded, and with due allowance made for

pasting the edges of the mouth to make a tight joint, will hold approximately 8 cubic feet.

In using paper bags for disinfection they should first be looked over for cracks and tears and these closed with strips of newspaper gummed in position with stiff flour paste. The seams are often poorly put together, and tightness may quickly be assured by thus pasting strips of newspaper over them.

The generator may be used either inside or outside the bag. After the articles are put in the open end is closed with flour paste applied to the inner edges, and the latter are folded on themselves and held tightly in position by ordinary paper clips, or the end may be closed with zinc-oxide plaster. If the generator is used outside the bag, the glass delivery tube may be thrust through the paper or inserted in the mouth before closing and a tight seam be made around it with zinc-oxide plaster.

Ordinary bag paper when dry allows the escape of very little gas through its pores. When blown up with gas, a little comes through so long as the internal pressure is greater than atmospheric pressure; but when these are equal, and as the gas inside cools down and thereby contracts in volume, there is little tendency to diffusion.

But if the paper becomes wet the condition is different, and the gas passes quite readily through the wetted spots, appearing as a whitish vapor. It thus becomes necessary to keep the paper bag from being wet. This can be done (*a*) by using a filling of paraffin or other substance. Such a bag is made by many concerns, as the Union Paper & Bag Co., of New York. Or by (*b*) wrapping the end of the delivery tube in gunny sack, towel, gauze, absorbent cotton, or similar material to soak up the excess moisture carried over with the formaldehyde, and thus prevent it from reaching and wetting the paper. Various other simple measures for meeting this need will also suggest themselves. An intercepting flask to catch this moisture has been tried, but was found undesirable in cold weather by reason of the occurrence of polymerization therein.

No difficulty was found in accomplishing disinfection in paper bags. This has many obvious advantages for the military service and for use in civil hospitals and elsewhere.

The same paper bag may, if desired, be used repeatedly, only about an inch of the margin of the mouth being necessarily sacrificed for each disinfection, as the best method of opening is to snip off the end with a pair of shears.

The weight is practically negligible; a paper bag 62 by 29 inches, more than capable of holding all the clothing and equipment of the soldier, weighs only half a pound. Twenty-five such bags and a generator would weigh no more than 20 pounds, and as many rub-

ber bags as might be needed in addition could be readily improvised in the field from rubber sheets and ponchos. To add an efficient disinfecting and insecticidal outfit to field hospitals would thus mean an utterly insignificant addition to their weight.

The paper bag also serves as a most efficient container for equipment after being used for disinfecting purposes. After disconnection with the generator, the bag and its contents may be sealed up and at once marked with the man's name and regiment and laid away until required, or it may be tied up to form a parcel and started back with the soldier if he is to be transferred. Under such circumstances a high percentage of gas remains in the bag and its contents for a number of days, thus absolutely reinsuring the complete destruction of all microorganisms and insects through the operation of a long-time factor.

The advantages of an expansible container, like a rubber or paper bag, are very great, and are among the chief factors in the success of the method here described. They accomplish exactly the same results as costly vacuum chambers, but much easier. The reason is that instead of air having to be withdrawn by pumping, as in the latter, so as to permit of a gas and air mixture being made in which the percentage of the former is high, the collapsible container starts with very little air in it and pure gas is blown in and distends this collapsed container to the degree desired. The latter is purely a matter of quantitative calculation of chemicals. No excess of gas pressure has to be provided for, since internal and atmospheric pressures merely balance. This concentration of gas naturally increases its penetration and tremendously shortens the correlative factor of time exposure, permitting gaseous disinfection to be accomplished in an infinitesimal fraction of the time exposure heretofore required.

THE RIGID CONTAINER FOR ARTICLES TO BE DISINFECTED.

The inelastic container, such as a trunk, box, closet, or room, has the disadvantage of starting full of air. As gas is blown in, air—and shortly a mixture of gas and air—will escape until internal and external pressures balance. The residual mixture in the container at the end of the gas generation is what accomplishes disinfection, subject to the more or less efficient measures taken to retain this admixture and limit further escape.

The apparatus here presented may be used for house disinfection, for rooms or chests. One of these little field machines can generate as much gas as is required by accepted sanitary standards for each 1,000 cubic feet. One such apparatus can be stood for generation in the ordinary hospital disinfecting closet, or used outside to blow gas therein. But its chief advantage for use in fixed containers is its small size, compactness, high efficiency, cleanliness of operation with-

out spattering and freedom from danger of fire, whereby it can be put directly among the infected contents of a trunk or locker, its plunger pushed, the trunk closed and, if necessary, sealed with paper strips, and the whole left while disinfection of the trunk contents is accomplished. The sample apparatus has been planned so that it would go under the tray of the soldier's trunk locker. The space of the latter is 8¾ inches deep—the apparatus is 8 inches high over all, without pressure on the plunger. Assume a case of infectious disease in barracks. There is no haulage of the man's effects away to be hung out, disinfected, replaced, and hauled back. The Hospital Corps man simply puts this little apparatus under his arm, proceeds to the barracks, the trunk is moved into the open air or an unoccupied space, the apparatus is nestled down into it among the clothes, the plunger pushed, the lid dropped and the trunk locked. Newspaper strips should be at hand to paste over the cracks. After a few hours the Hospital Corps man comes back for his machine, and the residual gas entangled in the meshes of the fabrics continues its disinfectant action when the trunk is returned to store.

It may be important here to know that the following set of articles of the uniform, viz, shirt, breeches, blouse, hat, shoes, blanket, overcoat, socks, and underwear, occupy approximately 2 cubic feet of space. Also, that the large box of dressings for field use has 2 cubic feet capacity; the trunk locker, 3¼; a flat rubber sheeting bag 30 by 60 inches holds, sealed, about 5 cubic feet, and a flat bag made of the poncho, 44 by 64, has about 8 cubic feet capacity.

REAGENTS WHICH MAY BE USED.

In experiments with this apparatus, formaldehyde generated from formalin by addition of potassium permanganate has been largely used. However, since part of the available formaldehyde is destroyed in reducing the permanganate in creating the necessary heat, it seemed desirable to find other substances which would utilize the water of the "formalin" for this purpose. Two of these, calcium carbide and quicklime, are also already officially supplied for other purposes in post and field, and are always available. Both work fairly efficiently, but for some reason better if the formalin is first diluted with an equal quantity of water. Lime, moreover, acts slowly. The calcium carbide develops acetylene, which of course dilutes the formaldehyde likewise sent over by the heat of the reaction, and thus somewhat retards efficiency; and both calcium carbide and quicklime, at the end of the reaction with formalin, turn into an orange-colored, gummy mass, which is not as easy as the gritty manganese hydroxide to remove from the generator. The nature of this residual substance is not known, but corresponds to that resulting

from the action of an alkali on an aldehyde, and a certain amount of formaldehyde is undoubtedly destroyed in its production.

The conclusions reached are that formaldehyde is best liberated from formalin by potassium permanganate; that either calcium carbide or quicklime may effectively be used in place of the latter, and that such substitution may be necessary under difficulties of supply in the field; and that if so substituted, increased quantities of the liquid and solid reagents, up to double amounts, should be used.

The apparatus also will, without change, deliver hydrocyanic acid gas, generated from potassium cyanide and an acid, safely and efficiently, if it is desired to destroy lice, fleas, bedbugs, chigoes, ticks, or other insects on clothing or bedding, by this agent. However, it will be shown that this apparatus uses formaldehyde so effectively as to quickly destroy insects and render the use of the above dangerous gas quite unnecessary.

With the very slight interior modification of an interchangeable interior part, the apparatus, tinned, will deliver sulphur dioxide from its liquified form.

This apparatus is thus universal in the sense that it is adapted to the use of all gaseous disinfectants in accepted employment by sanitarians, can be used to develop insecticides, and may be employed inside or outside of the container, and in contact or not with the articles to be disinfected or fumigated.

EFFICIENCY OF THE CHEMICAL REAGENTS.

It was important, for several reasons, to determine the amount of formaldehyde gas which could dependably be produced from given quantities of reagents under ordinary conditions. To this end a large number of laboratory tests were carried out in the retort and with the several experimental machines made for the purpose.

Summarized, it was found that the volume of gas produced depends not only upon quantity of reagents and their respective proportions, but upon other factors. If the amounts of the reagents employed are not sufficient to heat up the generator to a suitable temperature, no gas will be driven off the formalin and delivered. Also, if the amounts are so small that most of the heat generated goes to heat up the apparatus, the amount of gas which will be delivered has direct relation to this residual heat. Thus there is for each size of apparatus a quantity of each reagent which will operate the machine with least loss of efficiency. Thus an unnecessary amount of metal to heat up in the apparatus before gas delivery can begin has the same effect upon the latter as the use of reduced quantities of chemicals. The chemicals must also be properly proportioned, else the reaction will be incomplete so far as one of them is concerned. Thus 25 per cent by weight of potassium permanganate will develop but about

30 cubic centimeters of formaldehyde, as measured in the gasometer, from each 1 cubic centimeter of formalin used; while 40 per cent by weight of potassium permanganate, which seems the best proportion, will under average conditions develop approximately 77 cubic centimeters of this gas from each 1 cubic centimeter of the formalin used. Increasing this ratio (40 parts of potassium permanganate by weight to 100 parts of formalin by volume) developed no large proportion of gas. These proportions have been accepted as being most suitable for all purposes, leaving an approximately dry residue in the apparatus in which all the potassium permanganate has been reduced.

In cold weather the proportion of 77 cubic centimeters formaldehyde to each 1 cubic centimeter formalin used will not quite be attained, due to the use of greater proportion of the heat generated in raising the generator and its contained reagents to a temperature at which the gas begins to come over. Conversely, for the same reason the factor of available gas delivered will be as much as 10 per cent greater in warm weather.

STRENGTH OF THE GAS ADMIXTURE DEVELOPED.

In the ordinary methods for the use of formaldehyde, it is usually recommended to use 500 cubic centimeters of formalin per 1,000 cubic feet of space to be disinfected. As already stated, it has been found in the experiments of the writer that 1 cubic centimeter of formalin may be expected to yield approximately 77 cubic centimeters of gas, varying slightly with the products of different manufacturers, volatilization through age, temperature conditions, etc.

Using this factor we have: 500 cubic centimeters multiplied by 77 cubic centimeters equals 38,500 cubic centimeters gas produced. But 28 liters equals 1 cubic foot; hence 500 cubic centimeters formalin produces approximately 1.3 cubic feet of formaldehyde gas, or 1.3 parts per 1,000 of the cubic space, or a gas percentage of 0.13 per cent in the resulting admixture of gas and contained air. From this small percentage there is a still further but variable loss by escape of gas through diffusion and through polymerization.

But with the new method and apparatus, using a small machine containing, say, 150 cubic centimeters of formalin and discharging into a collapsible gas bag, there are 150 cubic centimeters multiplied by 77 cubic centimeters equals 11,500 cubic centimeters gas produced. If we press down the collapsible container to expel unnecessary air around its contents before sealing the gas bag and generating the formaldehyde, we will have a variable but always small number of liters of residual air remaining to dilute and impair the efficiency of the gas developed. If we assume, say, 4 liters of such "residual air" remaining, then 11,500 cubic centimeters plus 4,000 cubic centimeters equals 15,500 cubic centimeters gas and air mixture, of

which some 70 per cent is formaldehyde, and with no loss from leakage or polymerization.

But we have seen that in ordinary methods of room disinfection there will not be more than 0.13 per cent of gas. Hence the gas strength attained in the bag is nearly 550 times greater than is regarded as effective in ordinary room disinfection. While this gas strength will vary with the nature of the articles to be disinfected and the thoroughness with which "residual air" has been expelled from the gas bag, it is evident that under any circumstances articles in the gas bag will be exposed to a gas strength several hundred times greater than that attained by ordinary methods. As the "dose" of the gas has thus been so tremendously increased, it naturally follows that the correlating factor of time of exposure may be very greatly shortened and destruction of germ and insect life yet be accomplished with certainty. That this is the case in fact as well as theory has been amply demonstrated in the experimental work.

HIGH TEMPERATURE OF THE GAS.

In usual methods of disinfection the temperature of the admixture is low, as the proportion of the gas thrown in the space to be disinfected is but one or two parts per thousand of the inclosed air, while the surfaces also to be heated up are very great. The result, especially in cool weather, is a low temperature at which the gas may polymerize and in any case has a low capacity for holding moisture. In ordinary methods of room disinfection with formaldehyde, the temperature is only raised some 6° or 8° F. Harrington (Hygiene, p. 607) says: "It is agreed that the greater the degree of heat, the surer the action; and that below 60° F. favorable results can not be expected."

But with the new method, the greater part of the gas thrown off during the reaction is liberated at the temperature of boiling water. If conducted into a closed space through a tube, the resultant temperature is that of the final admixture of hot gas and cooler air, as modified by the container and contents. It is thus apparent that the greater the proportion of gas generated to air present, the higher the resulting temperature of their mixture.

With the new apparatus and collapsible container, the amount of gas generated may several times exceed that of the "residual air" present. The gas may thus represent as much as 70 or 80 per cent of the resulting admixture. If 10 liters of such a gas is blown in at 212° F. from a generator outside the gas bag, and mixed with some 3 liters of residual air at, say, the room temperature of 72° F., the resulting admixture will have a temperature of about 185° F.; reduced somewhat by the contents of the container but still high

enough as moist heat to probably inhibit germ growth and assist in its destruction.

But if the generator be placed within the container among the articles to be disinfected, the heat radiated and conducted from the apparatus further adds greatly to that of the gas thrown off, both as to temperature reached and duration of the period through which heat maintained. These factors are of course variable, but in any case they are very much greater than can be secured with any other apparatus or method. With the new machine the rise in temperature is thus 10 or 15 times higher than by the old methods. Even after half an hour a generator operated in a collapsible container at ordinary room temperature is still quite hot to the bare hands. This high temperature around, and of, the articles to be disinfected is not only very potent in securing maximum germicidal efficiency of the gas, but also greatly aids in the diffusion and penetrative quality of the latter in replacing air in the interstices of the fabrics by creating great difference in their respective specific gravities. This, of course, greatly aids in the greater rapidity, certainty, and deep penetration of the present disinfecting process.

However, the temperature attained is never high enough to injure the most delicate fabric, and thus possesses virtues without faults.

HIGH MOISTURE OF THE GAS.

It is well known that bacteria in the dry state are not as readily acted upon, in their destruction through coagulation of their protoplasm by formaldehyde, as are those which are moist. It is generally accepted that satisfactory results can not be obtained where the relative humidity is not above 65.

In old methods of disinfection a large amount of air is unavoidably present which in our climates is usually very far from saturation with water vapor, and the volume of which is so great that the volatilization of the water component of the necessary amount of formalin does not bring it to the saturation point. And beside a relative humidity below the maximum, its absolute humidity is also low as a necessary result of the low temperature of the gas and air admixture which unavoidably results in the old method.

But in the present method the gas is generated by a heat of chemical oxidation which is so great as in a few seconds to cause the water holding the gas in solution to boil and pass out of the apparatus with it as steam vapor. Such a large amount of moisture is thus thrown into the collapsible container as to bring its contents of gas and air at once to the point of aqueous saturation at a high temperature, in which both absolute and relative humidity is at the maximum; and as this temperature falls with resulting condensation, the mixture of gas and air constantly remains at the dew point for its

temperature. Thus, as the saturated gas which has penetrated into the interstices of fabrics cools down, it deposits its conveyed moisture throughout the material, holding in solution the gas which promptly redissolves in it on its condensation. The result is thus practically the same as painting a thin film of "formalin" over every fiber of the material and any germs on it which are to be destroyed.

POLYMERIZATION.

Below a temperature of 62° F., formaldehyde gas tends to polymerize into its isomeric solid form of paraform, which latter is practically valueless for disinfection purposes. This is the case to such an extent that in cold weather formaldehyde generated in the usual way is absolutely unreliable for room and other disinfection, for the heated gas is rapidly cooled down below that point by admixture with the cold air and contact with the cold surfaces of the container and its contents.

But with the new method, and especially when the new apparatus is used inside a collapsible gas bag, the small amount of residual air and the contents of the gas bag are rapidly heated up by the relatively large amount of incoming gas to a temperature much above that at which polymerization occurs. Further, much additional heat is more slowly radiated and conducted from the generating apparatus, which thus acts as a stove to heat up the disinfecting space and delays cooling down for a long enough time to enable the gas to efficiently perform its disinfectant function before it can polymerize. The use of this heat, which would otherwise be lost, makes all the difference between success and failure of disinfection in cold weather. This cooling down can be further retarded, if desired, by spreading a blanket over the gas bag or other disinfecting container to hold in the heat.

If formaldehyde is delivered through a tube in cold weather much polymerization will occur in the tube itself.

For this reason it is desirable, though not necessary, to warm up the generating apparatus to blood heat or higher in cold weather before starting it into operation, as an economy of chemicals and better liberation of gas results.

EFFICIENCY OF APPARATUS.

To determine the efficiency of the method and apparatus, the following calculation was employed:

The atomic weight of H_2O is 18; that of (formaldehyde) CH_2O is 30. Assume 100 cubic centimeters of formalin used.

Then $30:18::100:x$ equals 60, which would be weight in grams of CH_2O if completely soluble in water. But as only 40 per cent by weight can be so taken up, then 60 multiplied by 0.40 equals 24 grams.

But 1 liter of hydrogen weighs 0.0896 gram at 0° C. temperature and 760 millimeters pressure; and as CH_2O has the atomic weight of 30, we have 0 0896 multiplied by 30 equals 2.688 grams equals weight of 1 liter of CH_2O. We are seen to have 24 grams of the gas, hence 24 divided by 2.688 equals 8.928 liters of gas.

But the machine has by measurement actually developed under usual conditions but 7.700 liters of gas from 100 cubic centimeters of formalin. The method and apparatus may thus be regarded as about 86 per cent efficient; about 14 per cent of the theoretically available formaldehyde being used up in combining with the potassium permanganate in heating up the chemicals and apparatus to a point where gas will be delivered by the latter.

CAPACITY OF GENERATOR.

The capacity of a generator depends upon the amount of the reagents which may be mixed therein without anything but gas and vapor being passed out. If overloaded, particles of manganese hydroxide and unoxidized potassium permanganate will be thrown out by the violence of the reaction, and these stain clothing. The maximum load is somewhat modified by temperature conditions and the amount of metal to be heated up. For ordinary field work a generator like this sample, which would hold 300 cubic centimeters of formalin and 120 cubic centimeters of potassium permanganate or more will not only do all the work required but is perhaps unnecessarily large. Loads much smaller than the maximum may be used in the same machine, and several different sizes of generators are made to meet diverse conditions. The size of the dosing box is proportioned for each apparatus, so as to contain no more reagent than required for the reaction to which such machine is adapted.

SIMPLICITY OF GENERATOR.

Old types of apparatus are complicated, consist of many parts, and require skilled attention during operation.

The new apparatus is most simple, and has but four parts, all of which are strong, durable, easily assembled and taken apart in less than half a minute. It can be operated without trouble or danger by anyone with sufficient intelligence to fill measured containers with chemicals and push down a plunger.

COMPACTNESS AND PORTABILITY OF APPARATUS.

The old generators are large, heavy, cumbersome, composed of many parts, and liable to breakage.

The new apparatus is extremely compact and portable, being practically nothing but a strong cylinder with but three small external projections. All parts of this apparatus, including a flexible tube

for delivery of the gas, pack within this cylinder. The apparatus is thus entirely self-contained, which is obviously highly advantageous, and especially for field and health department work. There is nothing to break or get out of order.

A metal bail handle may be put on the generator to facilitate carrying. The ordinary size of this apparatus to best meet the needs of military field use is 8 inches high and 6 inches in diameter. Its weight is but 5 pounds, though it will do the work better than some other machines having the same purpose and weighing ten times as much.

WEIGHT OF APPARATUS.

The weight of old-style generating apparatus is considerable, depending, of course, on capacity and size.

The new machine, of a size to develop the same volume of gas, will weigh in the neighborhood of a fifth as much, or less, depending on the old apparatus with which compared. The new apparatus of a size recommended for ordinary clothing disinfection weighs 5 pounds, and a paper-bag container accommodating a couple of soldiers' equipments weighs but a half pound more. A rubber bag 3 by 5 feet weighs but 4 pounds. A generator and enough paper containers to disinfect at one time the belongings of 30 soldiers can thus be carried under the arm.

CARE IN OPERATION OF APPARATUS.

With old apparatus, as soon as the formalin has been boiled out, the flame used to liberate it must be extinguished, else the apparatus will become intensely overheated, may cause fire, and may itself be ruined. Autoclaves which are not automatic in discharging their contents when a given pressure is reached must be watched and operated by hand.

But the new apparatus is self-controlled. With completion of the reaction of the chemicals with which it is charged, its operation necessarily stops. It can be abandoned in operation anywhere with the positive knowledge that it needs no further attention.

FREEDOM OF APPARATUS FROM DANGER OF FIRE.

In all other apparatus the liberation of formaldehyde is accomplished by heat applied by a naked external flame. To abandon the latter in a closed space has obvious serious disadvantages, while its use outside such a space where it can be reached exposes it to greater danger of being knocked over or other accident. Moreover, the naked flame renders it impossible to place such a generator in contact or close proximity to articles to be disinfected.

With the new apparatus no flame is necessary. The temperature can never exceed that of boiling water, for as soon as vaporization of

the watery formaldehyde solution ceases, nothing is left to react with the chemical solids employed, the reaction ceases, and temperature falls. This apparatus is thus absolutely safe, and can be placed, like a kettle full of boiling water, in close contact with the most delicate fabric without danger of fire or scorching.

FREEDOM OF APPARATUS FROM DANGER OF EXPLOSION.

This apparatus has two vent pipes of relatively large bore; only one of which has a turncock by which it can be closed, while the other is always open. There is thus always ready escape for gas as generated, and danger of explosion from its confinement through ignorance or carelessness is thus wholly impossible. This is not the case with the most efficient type of generators using a flame to liberate the gas—the autoclave apparatus—in which explosions have frequently occurred; nor is there any lamp to explode, as is the case with apparatus using external heat.

RAPIDITY OF GENERATION OF GAS.

The brief time thus required to completely deliver the gas with the new apparatus—approximately two minutes—not only greatly assists in the process of disinfection itself, but greatly adds to the utility of the method. A single one of the new machines is thus enabled in the same time to accomplish as much work as the aggregate of many others representing the best of the old type.

This greater rapidity of operation has a marked effect on cost, for much fewer of the new machines need be purchased and kept on hand to do a given amount of work than would be required in the case of any models of the old apparatus.

If used outside a container, a single generator can be connected, complete its operation, be disconnected, opened, washed out in a bucket of water, be recharged and ready for another operation within five minutes.

One small generator could thus disinfect a dozen bags of clothing per hour. If bags improvised from soldiers' ponchos are used—each of which will hold the outfit of three men—one of these little machines will disinfect, or destroy insect life on, the clothing of an entire battalion of 500 men between dawn and dusk. It will deliver gas to the disinfecting bags as fast as a man could put the necessary articles into these disinfecting bags and seal them up.

CLEANING OF APPARATUS.

All that is necessary to clean the apparatus is to open it and flush it out with water from a faucet or poured into it from a bucket. The manganese hydroxide resulting from the reaction is a coarse, gritty residue which manifests no tendency to adhere to the apparatus and

is washed out as easily as so much sand. Simply sousing the parts two or three times in a bucket of water efficiently cleans them. The water is merely shaken off. It is not necessary to dry the parts by wiping even the dosing box, though the latter may be wiped over with a bit of gunny sack or cloth.

COST OF APPARATUS.

The old apparatus are relatively very costly for the results accomplished, by reason of their size, weight, and complicated construction and number required.

The cost of the new machine is trifling, and it will do the work of apparatus costing many times the money. Moreover, one such new model machine will, through its much shorter period of operation, do the work of many other apparatus in the same length of time. Further, by its employment with a collapsible gas bag in clothing and bedding disinfection, gas strengths are at once secured which with the old type of apparatus can only be obtained by the use of costly, bulky, and heavy vacuum chambers with exhaust pumps strong enough to resist atmospheric pressure. Generally speaking, its cost as compared with other apparatus is as many times less as its efficiency is times greater.

USE OF APPARATUS IN SMALL SPACES.

It is of the greatest importance, in formaldehyde disinfection, to secure and maintain the highest degrees of gas strength, gas moisture, and gas heat.

The old apparatus can not be used in small spaces, by reason of bulk and danger of fire from their naked flame—also from the fact that the latter would soon burn up all available oxygen and go out.

But the new apparatus can safely be used to generate gas in any space large enough to hold it, thus securing the maximum gas strength, heat, and humidity necessary to great efficiency. Moreover, as its operation is the result of chemical action, the presence of air and oxygen is a nonessential; in fact, it is a detriment, and the special advantage of the new apparatus largely depends upon air exclusion.

GERMICIDAL EFFICIENCY OF THE APPARATUS AND METHOD.

The following experiments were made, using bits of sterile gauze soaked in pure cultures of the organisms used, wrapped in several thicknesses of sterile gauze and the whole disposed about as follows: Under sweatband of cap; under one, two, three, and four thicknesses of towel; under one, two, three, and four thicknesses of army blanket.

A large number of experiments were made with *Bacillus prodigiosus*, using variable quantities of reagents. These developed the fact that,

for rapid and certain sterilization, not less than 100 cubic centimeters formalin should be used with the field apparatus employed. Using 100 cubic centimeters formalin and a time exposure of from 1½ hours down to 30 minutes, of a total of 93 cultures used in 23 tests all remained sterile, though the controls showed growth in all cases.

Using *Bacillus coli*, the following results were obtained:

(*a*) With 2 hours' exposure and 100 cubic centimeters formalin, 16 cultures, all sterile; controls show heavy growth.

(*b*) With 1½ hours' exposure and 100 cubic centimeters formalin, 16 cultures, all sterile; controls show heavy growth.

(*c*) With 30 minutes' exposure and 100 cubic centimeters formalin, 16 cultures, all sterile; controls show heavy growth.

(*d*) With 20 minutes' exposure and 100 cubic centimeters formalin, 22 cultures, 20 sterile; 2 under four thicknesses of blanket ultimately show slight growth; controls show heavy growth.

(*e*) With 15 minutes' exposure and 100 cubic centimeters formalin, 7 cultures, 6 showed growth, 1 negative.

Result for *Bacillus coli*, 69 cultures of 20 minutes or longer exposure, using 100 cubic centimeters formalin, 67 sterile, 2 show slight growth; with 15 minutes' exposure, 6 out of 7 show growth.

A number of experiments were made with feces. Here growth seemed to depend, as might be expected, not only in the time of exposure but on the thickness of the smear, as mucus and coagulated albuminous matter interfered with penetration of the gas to the deeper portions of the smear. Of 37 such smears, included in six experiments, only about half were made sterile in less than 45 minutes; but 16 strong watery emulsions of feces were sterilized in 30 minutes. For fecal contamination, then, either the amount of reagents should be considerably increased or the minimum time exposure should be more than doubled.

I desire here to express my great indebtedness and thanks to Lieut. George B. Foster, Medical Corps, in charge of the laboratory of the central division, who not only conducted the bacteriological end of this work, but was kind enough to follow its progress otherwise and check up the accuracy of various other conclusions reached and presented in this paper.

The conclusions reached by about 50 experiments including over 200 cultures are that using 100 cubic centimeters of formalin in the apparatus here exhibited as suitable for disinfection in the field, sterilization of bedding and clothing may habitually be relied upon to be accomplished in about 20 minutes, and by increasing the amount and hence relative strength of the gas, there is every reason to believe that this brief time factor may readily be reduced to 15 minutes or even lower, if thought desirable. Articles soiled with

feces will, other things being equal, require a time exposure two or three times as long.

Further work with other microorganisms, which lack of time has heretofore prevented, is contemplated.

The penetrative powers of formaldehyde being slight under ordinary conditions, it has been commonly looked upon as uncertain for other than surface disinfection. Clothing, to be disinfected, is recommended to be well spread out and exposed to the gas for at least 8 or 10 hours under the best conditions, and preferably longer.

By the new method this may be accomplished in approximately one twenty-fifth or less of the time heretofore required, or with, say, 4 to 2 per cent of the time exposure heretofore found to be necessary. This tremendous saving of time has many obvious advantages, not only for disinfection in the field but for that in civil life.

DESTRUCTION OF INSECT PARASITES.

It is well known that formaldehyde gas as heretofore applied is practically innocuous to insect life. This is the result of their exposure to a large volume of air which necessarily can contain only a very small proportion of formaldehyde.

But this gas is very fatal to insect life if strong enough, hot enough, and moist enough; and the new apparatus, which is so promptly effective against bacterial life, is even more potent against insects. Hence the use of hydrocyanic acid gas, or of sulphur dioxide, for the use of both of which this new apparatus is adapted, if desired, becomes quite unnecessary.

Especially with the collapsible container, the resulting mixture to which the insects are exposed contains a very small proportion of air—in itself with probably insufficient oxygen long to support life—and a very large proportion of formaldehyde, which directly attacks and combines with cellular protoplasm.

With the new apparatus and collapsible container, bedbugs, flies, ants, roaches, water bugs, etc., are practically always killed by as short an exposure as eight minutes, while an exposure of twice that length would make assurance doubly sure and still mean only a trifling time necessary for insect destruction. Vermin on garments and bedding can thus be destroyed while the owner waits.

No other apparatus and method using formaldehyde will destroy insect parasites; and the ability of the new machine promptly to kill every noxious insect on clothing and bedding while destroying all bacterial life, places it in a class by itself and opens up a wide field of usefulness in the destruction of insect parasites in camp and garrison, on shipboard, in board of health work, and the unending struggle for the control of vermin in hospitals, dispensaries, jails, asylums, lodging houses, and the like.

FIELDS OF USEFULNESS OF THE APPARATUS AND METHOD.

This apparatus has many advantages over all others, in civil life as well as in the military service, wherever a deodorizing, disinfectant, or insecticidal action is required. It should be made in several sizes to meet these several needs under diverse conditions.

For use in deodorizing, a small apparatus operated in a refrigerator, cold-storage room, butcher shop, or other place where putrescible material is kept, cellar, closet, room, or other closed space will promptly destroy any offensive or close odor therein.

For disinfecting clothing, bedding, baggage, wearing apparel, books, etc., a small apparatus may be operated inside of a trunk, box, or closet, but somewhat better and quicker results will be secured by the use of a collapsible container for these articles, the generator developing the gas inside this container or blowing it in from the outside. This is especially applicable to disinfection in camps, on board ship, at quarantine stations, for board of health work, for hospitals, prisons, public institutions, schools, colleges, hotels, and places of public accommodation.

For disinfecting rooms or similar large spaces, one or more generators containing the aggregate amount of reagents necessary to produce a disinfectant strength of gas for the cubic space concerned are either set in such space itself, or they are set outside and gas delivered by a rubber tube through a keyhole or other convenient aperture. This is particularly applicable to garrison use and house disinfection by the health authorities after cases of infectious disease.

For disinfecting the instruments of surgeons or dentists, a small generator is simply put inside the instrument closet and set into operation among the shelves or trays.

For destroying insect parasites on clothing or bedding, the apparatus prepared to generate formaldehyde (or hydrocyanic acid or sulphur dioxide, if desired) is operated with a collapsible container, either inside or outside of the latter. This apparatus and method is the only one capable of destroying insect parasites with formaldehyde. It should thus be of great value in hospitals, dispensaries, on board ships, in military camps and garrisons, in jails, prisons and reformatories, in asylums and charitable institutions, for health officers and boards of health, for hotels and lodging houses, by physicians in their practice, and under all conditions where want, misery, ailment, poverty, or aggregation of large numbers of persons in close contact interfere with maintenance of cleanliness and hygiene of the person and its coverings. Also by housewives and by dealers in furs, woolens, and other articles liable to depredation by moths, in destroying the latter and protecting their property.

PERSONAL HYGIENE IN THE FIELD, INCLUDING THE DISINFECTION OF CLOTHING AND EQUIPMENT WITH AND WITHOUT APPARATUS.

Maj. Powell C. Fauntleroy, Medical Corps, United States Army.

In our modern military posts we find about all the barriers and safeguards against the entrance and spread of disease that public hygiene interposes for the protection of the health of communities, and while the soldier here is taught that he owes it to himself and to his comrades to maintain habits of personal cleanliness and keep his immediate surroundings in as cleanly a state as his own person, and cultivate such other habits of life as conduce to a healthy existence, he can not fully realize the extent of the value of such protection, and how much individual effort he is saved, until his organization is sent into the field and constitutes one of the many units of a large camp, and the work of establishing and maintaining such hygienic protection falls upon him and his comrades. But while the soldier may not appreciate to their full value the lessons of personal hygiene taught him in the garrison, it is just in proportion to the thoroughness or not of this home training that the work of the sanitary inspector in the field is easy and effectual or excessively trying and at times ineffectual.

The more time we effectually spend during peace in inculcating in the soldier the lessons of hygiene the more happy will be the lot of all concerned in the field, when most of our strength is needed to meet the ordinary duties incident to such service and all our reserve for the exhausting duties incident to actual conflict with the enemy. In the United States, where military service is voluntary and almost the entire bulk of the forces that would be assembled for service against a first-class power would be made up of untrained men, the systematic instruction in hygiene should be compulsory in all schools. If such preparation has been made, the sanitary officer will at least have a fertile soil upon which to sow his seed, and with proper assistance a good chance of maintaining the health of the command.

The popular and very large association known as the Boy Scouts would afford an excellent opportunity to instruct a large number of the youth of the country in the practical application of camp and personal hygiene.

The class of men upon which to-day the Regular Army, and to a very large extent the militia, depend upon from which to recruit, is that of the roving and relatively unsettled men of the country. This class of men, upon which the military establishment depends for an orderly carrying out of its purposes, are of very limited education, and therefore we find that military instructions and procedures are necessarily the simplest and most elementary in character, in order that

they may be adapted to the intelligence of the average unskilled laborer.

If we expect to have the individual and collective cooperation of the military organizations in maintaining a system of personal hygiene, our sanitary instructions must be in the most elementary form and call for the simplest and most easily carried-out procedures that will accomplish the desired result.

The time and facilities for maintaining personal cleanliness can not always be commanded by the soldier, but if he takes advantage of the opportunities when they arise, they will be found to occur frequently enough to enable him to keep his person and clothing in a cleanly condition.

This should not be left to chance occasions, but every facility possible should be provided, and the time set apart for bathing and washing.

The hands should be washed with soap and water after visiting the latrine, and before meals. The toothbrush should be used after each meal. After the day's work a full bath, if possible, should be taken, but if from scarcity of water it is not possible, at least the feet, flexures, and hairy portions of the body should be washed with soap and water. If clean clothes are not at hand and the same clothing has to be worn that has been in use during the day on the march, they should be well shaken and turned inside out, and exposed to the sun and air. Such clothing should not be allowed to become hard from dirt and dried sweat before washing. They should be washed at least twice a week, boiling if possible. The feet, hair, and nails are particularly exposed to dust and dirt and should be given special attention to keep them in a cleanly condition. The hair and nails should be kept trimmed, and the feet clean, and blisters or abrasions properly treated. Properly fitting socks and shoes with the use of soap, grease, or foot powder will largely eliminate injury to the feet, incident to marching. Much discomfort, fatigue, and actual disease can be prevented by the use of suitable headgear and clothing.

The campaign hat should not be too heavy, but of good material, lined with black, with a broad brim, tolerably high crown, ventilated by large eyelets in front and on the sides, and a ventilating sweatband to enable the air to circulate freely around and over the head, and so promote rapid evaporation of sweat and protect the large nervous masses from the irritating and depressing influences of heat, and the chemical rays of the sun. A strip of black material 6 inches wide sewed down the back on the inside of the overshirt or blouse, will likewise protect the spine from the actinic rays.

The clothing should be of suitable material, loose but of proper shape and proportion, so that it will at all times adjust itself to the body and not be a source of discomfort by abrading the skin or constricting the circulation or impeding muscular action.

Such a state of personal cleanliness can not be expected unless maintained by daily inspection by company officers. Many men will never bathe at all unless forcibly taught habits of cleanliness, and many will permit themselves to become filthy and malodorous before they consider it actually necessary to bathe their person and wash their clothing. Hence, little can be expected unless by careful inspection and supervision company officers carry out the simple procedures for personal cleanliness.

The soldier should be instructed in regard to the wholesomeness of the water and food, and the necessity of keeping his bowels active and free from irritating substances.

The soldier must exercise the same care in keeping his immediate surroundings clean, that he does in maintaining his personal cleanliness.

His bedding, clothing, and equipment should be kept free from dust and exposed to the action of sun and air for several hours every day. Tent walls should be kept raised during the day, the weather permitting, and the floor cleaned and exposed to the sun and air.

He should have access to boiling water in which to thoroughly cleanse his mess kit once daily. He should likewise scald out his canteen when the purity of the water can not be assured.

The chilling and depressing influence of sleeping directly upon the ground should be avoided by improvising a cot or if no other means are feasible by interposing the poncho between the body and the ground.

In camp, the soldier must be given a chance to engage in athletic sports and entertainments, largely of an amusing nature, for nothing more surely undermines health, discipline, and efficiency than discontent and ennui, incident to the humdrum monotony of purely military duty in camp.

The disinfection in the field of the soldier's clothing and equipment when necessary for a small number, can usually be readily accomplished by boiling for 10 minutes in water the washable articles, and immersion for two hours of the nonwashable articles in a 5 per cent cresol-soap solution or 5 per cent formalin solution. To disinfect the person thoroughly wash with hot water and soap, then follow with a 1 : 2000 bichlorid of mercury solution, or 1 : 100 cresol-soap solution.

The powerful disinfecting action of the direct sunlight and fresh air should be used whenever available in conjunction with the above-mentioned means. When large quantities of clothing and equip-

ment are to be disinfected, a portable large-size Kenyon-Francis disinfecting apparatus, with formaldehyde attachment, should be brought into camp, as much time thereby can be saved, and more satisfactory results obtained, than by any other method suitable for extensive disinfection.

DISCUSSION.

A. C. Girard, Brigadier General, United States Army, late Assistant Surgeon General, United States Army: The paper of Col. Havard suggests, in a few words, the inversion of tents for the purification of their walls. This method of exposing the inner surface of the tents to the air and the sun, to my knowledge, has not been carried out heretofore. During the Spanish-American War, in which I was chief surgeon of the Second Army Corps, among other means of arresting the spread of typhoid fever, we rented a large tannery, in the vats of which the tents of some regiments were boiled, to the detriment of the impermeability of the canvas, though the method undoubtedly was of use in arresting infection. The method of inverting tents, while causing slight inconvenience, seems to be the most logical method of exposing the infected surface of the tent to the action of air and sun.

Lieut. Col. F. R. Keefer, Medical Corps, United States Army: The disinfecting device presented to the section by Maj. Munson marks a great advance in gaseous disinfection in field service. We have been obliged to depend heretofore either upon a large engine, which is available only at the base, or such makeshift appliance as we may improvise. For example, a large box, in which the equipments undergoing disinfection must remain for some hours. The new device is so simple, portable, cheap, and prompt in its action, each regiment may be supplied with one. This, with a few pounds of paraform and some proper bags, will add but little to the load of the regimental dispensary, while greatly increasing our ability to control disease.

Stabsarzt Hüne: 1. Gerade in der Zukunft müssen wir trotz der weiten Ausdehnung der Schlachtlinie mit grossen Truppenversammlungen rechnen. (Deutsche Kaisermanöver mit circa 8 Divisionen.) Die Truppenärzte haben zu jeder Zeit, schon auf dem Marsche hygienische Massnahmen zu treffen. Der Stand der Seuchen in der Zivilbevölkerung spielt bei dem Ausbruch von Epidemien die Hauptrolle und bedingt die anzuwendende Vorsichtsmassregeln.

2. Waschlappen den Soldaten mitzugeben, ist unzweckmässig; sie werden allmählich schmutzig und meist wohl nass in das Gepäk verpackt; ebenso ist Zahnpulver überflüssig. Der Soldat ist zu möglichst guter mechanischer Reinigung des Mundes, besonders der Zähne zu erziehen.

3. Improvisierte Dampfdesinfektion in Kisten (Dampf oben einleiten) oder in leicht herstellbaren Doppelcylindern aus Eisenblech auf Kochtöpfe gestellt.

4. Bücherdesinfektion durch Vorerhitzen auf ca. 120° C. und Desinfektion in gewöhnlichen Dampfdesinfektionsapparaten mit und ohne Ueberdruck ohne in Betracht kommende Schädigung der Bücher und Akten ist möglich.

5. Als mechanisches Universal-Desinfektionsmittel ist Cresolseifenlösung der Formalinlösung vorzuziehen; ersteres ist Reinigungs- und Desinfektionsmittel; Formalin belästigt durch Hartwerden der Haut und Reizung der Schleimhäute (Augen, Mund, Lungen). Coagulation von Eiweiss (Blutflecke in Wäsche).

THE PREVENTION OF TYPHOID FEVER BY BACTERIAL VACCINE.

FREDERICK F. RUSSELL, Major, Medical Corps, United States Army; Director, Bacteriological Laboratory, Army Medical School, Washington, D. C.

It is now a little more than three years since we, in the Army, began our present campaign against typhoid fever, using antityphoid vaccine with the idea of immunizing each individual soldier.

That the ordinary means of prevention are not available for the protection of the health of soldiers in the field is well known. They live in camps and consequently lack the public works, the safe water supply and sewerage systems of permanent communities. Many efforts have, and will continue to be made, to furnish troops in camp and on the march with unpolluted water and suitable food; but the difficulties to be overcome are enormous, and complete success has rarely attended the efforts of field sanitarians.

The experience of our troops in the war of 1898 is still fresh in our minds. It will be remembered that among 120,000 men we had 20,730 cases and 1,580 deaths, or about 1 case of typhoid to every 5 men. During the Boer War the English Army had 31,000 cases and 5,877 deaths. During the Franco-Prussian War there were 73,396 cases and 8,789 deaths among the German troops alone; in fact, 60 per cent of their total mortality was due to typhoid fever. The records of the Civil War show that there were over 80,000 cases in the northern Army.

In the country at large we know that the disease is altogether too prevalent; in 1910, in the registration area of the United States, which comprises only 58 per cent of the total population, there were 12,673 deaths from typhoid fever, or 23.5 per 100,000 population.

From these figures it is evident that there is no more important problem for military surgeons in war times than the prevention of typhoid fever; consequently we have attacked the disease from all

sides. Every effort is made to supply pure water and uncontaminated, wholesome food. Improved methods of camp sanitation have lessened the difficulties due to flies and the lack of a sewerage system. Nevertheless, we know that in time of war this system of sanitary safeguards would break down and typhoid fever again become the formidable antagonist it has been in the past. For this reason we began, as I have stated, to vaccinate each and every individual against typhoid as well as against smallpox; the two vaccinations being carried out simultaneously, one on either arm.

Bacterial vaccines against typhoid were first used by Pfeiffer and Kolle in Germany (Deut. Med. Wochenschr. 1896, 735), and by Sir A. E. Wright in England (Lancet, Lond., Sept. 19, 97, 807, and Brit. Med. Jour., Jan. 30, 1897, 16). The changes in the blood serum after vaccination were studied first by Pfeiffer and Kolle and afterwards by Wright, so far as was possible with the laboratory methods in use at that time, and the same immune bodies were found in the serum after vaccination with killed typhoid baccilli as were found after an attack of typhoid fever.

Thus early in its history was the practice of preventive inoculation placed upon a firm scientific basis.

Pfeiffer and Kolle made no practical use of their vaccine at the time, but Wright, working in England, reported in 1897 on the inoculation of 18 persons; and in 1898, while on duty in India, he vaccinated 4,000 men of the British Indian Army, with very encouraging results.

In 1900, on the outbreak of the Boer War, Wright, being again back in England, urged upon the War Office the use of the prophylactic on troops destined for South Africa. He furnished during this war some 400,000 doses, and it is believed that approximately 100,000 men were inoculated one or more times. While the results in South Africa (McCrae, Oslers Modern Medicine, Vol. II, Phil.) were unquestionably good, the incidence of the disease being diminished approximately one-half and the mortality nearly two-thirds among the inoculated, they were not so satisfactory as had been expected. Indeed, there were some who believed inoculation did more harm than good, supposedly increasing the susceptibility to infection. This view was, in a measure, accepted by Wright and explained by him as a manifestation of a negative phase in the process of immunization. This idea, together with other unfavorable reports, led to a cessation of the work toward the end of the war.

In 1904 to 1907 a typhoid vaccine prepared after the method of Pfeiffer and Kolle was used in the German Colonial Army in south West Africa, over 7,000 men out of a total army of 16,500 being inoculated, with results approximately the same as those obtained among the British in South Africa.

Sir William B. Leishman, of the Royal Army Medical Corps, took up the work in England in 1904 and in 1909 published such remarkably good results that our attention was again called to the matter. (Maj. H. J. M. Buist. Jour. Roy. Army Med. Corps., Lond., 1907, IX, 613; Leishman, ibid., 1909, XII, 163.)

Col. Leishman has continued his investigations and has recently (Harben Lecture, Jour. Roy. Inst. Pub. Health., Lond., 1910, XVIII, 515) stated his belief that the poor results obtained in the earlier work in South Africa were, in all probability, due to the use of a vaccine which had been rendered relatively inert by the use of too great heat in killing the bacteria. This course of error once recognized, it became an easy matter to prepare an efficient vaccine by killing the bacteria at a lower temperature (53° C.).

The vaccine used in England at the present time is prepared by growing the typhoid bacilli for 48 hours in nutrient broth, which is then sterilized by heating to 53° C. for one hour. The bacilli are counted while still living, and enough sterile broth added to give a strength of 1,000,000 bacilli to each cubic centimeter of fluid. One-quarter of 1 per cent of lysol is then added as a matter of safety.

In Germany and in our own country 18-hour agar cultures have been used rather than broth, since we believed a heavier growth may thus be obtained in a shorter time; contaminations can be more easily detected and the quantity of foreign proteids, peptone and beef extract injected is less; especially since salt solution rather than broth is used as a diluent. In our method the bacteria are grown on agar in large flasks, the growth after 18 hours incubation is washed off, the suspension is standardized by counting the bacilli by Wright's method, and enough physiological salt solution added to make each cubic centimeter contain 1,000,000 dead typhoid bacilli. The suspension is sterilized before dilution by heating for one hour at 54° to 55° C. We add one-quarter of 1 per cent of tricresol to the sterile vaccine to protect it against accidental contamination during the subsequent handling. The vacine is not polyvalent, only one carefully selected strain of *b. typhosis* being used.

The vaccine is injected into the subcutaneous tissue of the upper arm at the level of the insertion of the deltoid muscle, after the skin has been sterilized with tincture of iodine, no further preparation having been found necessary. It is deemed important that the vaccine be injected subcutaneously and not into the muscle since slow rather than rapid absorption is desired.

There are, as a rule, no symptoms immediately after the injection, but in the course of a few hours both a local and a general reaction may become apparent. The local reaction is manifested by a red and tender area, an inch or two in diameter, at the site of inoculation; the axillary lymph nodes are occasionally swollen and tender for a

few hours, but the process never goes on to suppuration. The local reaction begins to subside in 10 to 12 hours and disappears in 36 to 48 hours. The same series of changes, though in a less well-marked form, follow the second and third doses.

The general reaction varies more than the local in its symptoms, and is often mild or even absent. The average general reaction can be fairly well compared to the first few hours of an acute cold. The usual symptoms are moderate headache and malaise, but in occasional cases the symptoms may for a short time be quite severe; nausea, vomiting, and diarrhea being present with a temporary rise of temperature and chills. *Herpes labialis* is occasionally seen and *albuminuria* rarely. Accurate records were kept of the general reactions during three years, and have been consolidated in the following table:

TABLE I.—*Classification of general reaction.*

	Number of doses.	Absent.	Mild.	Moderate.	Severe.
		Per cent.			
First dose	45,680	68.5	28.9	2.4	0.3
Second dose	44,321	71.3	25.7	2.6	.2
Third dose	38,902	78.0	20.3	1.5	.1

General reactions were absent or mild in 97 per cent of all inoculated, and severe reactions occurred in only one to three persons per thousand.

The fear of a severe general reaction has, no doubt, deterred some persons from taking the treatment; the first dose once taken, however, the others follow without controversy, scarcely anyone having refused to continue the treatment. In actual practice the reactions have not caused any difficulty and no permanent damage or disability has followed the use of the prophylactic. We have seen no evidence whatever of a harmful negative phase.

In children and young people the general reactions are insignificant, no severe reactions whatever having been so far reported. The immunization is particularly well borne and of high degree, as judged both by the antibody production and the subsequent freedom from infection. No cases of typhoid have yet been reported among several hundred children immunized.

In the administration of so many hypodermic injections, about 400,000, one would naturally expect a few accidents, yet only one has been reported, a temporary mesculo-spiral neuritis. These facts demonstrate quite clearly that there are not insuperable obstacles in manufacturing and administering antityphoid vaccine on a large scale.

The result of the immunization can be judged by two standards—those of the laboratory and of actual practice. As has already been

stated, the immunity conferred by vaccination differs in no way, except possibly in its duration, from the immunity produced by an attack of the disease. Agglutinins, bacteriolysins, opsonins, and complement fixing bodies are all present in large quantities in the blood serum for periods of 6 to 18 months or more.

A better and more accurate idea of the protection conferred may be gained from the study of statistics, and the following table has been prepared to show the number of cases of typhoid fever in the Army for a number of years, with the incidence and death rates per thousand of mean strength:

TABLE II.—*Typhoid fever, cases and deaths, with ratio per thousand of mean strength per annum.*

Year.	Cases.	Ratio.	Deaths.	Ratio.	Cases in vaccinated persons.	Deaths in vaccinated persons.
1901	552	6.74	72	0.88	.....	.....
1902	565	6.99	69	.85	.....	.....
1903	348	5.14	30	.44	.....	.....
1904	280	4.77	20	.33	.....	.....
1905	193	3.39	17	.29	.....	.....
1906	347	6.15	15	.26	.....	.....
1907	208	3.87	16	.29	.....	.....
1908	239	3.20	24	.31	.....	.....
1909	282	3.35	22	.26	.....	.....
1910	198	2.43	14	.17	.....	.....
1911	68	.82	8	.097	12	1
1912 (6 months)	16	.376	1	.032	4	.....

Ratios for 1912 are based on experience for the first half year.

The table does not show the proportion of the Army vaccinated. Since the number, at first quite small, has constantly grown, a fair idea may be obtained from the following: A few persons, about 1,000, were vaccinated in 1909; in 1910 volunteers were numerous, and 16,000 were immunized; in 1911 the vaccination was made compulsory for the maneuver division, about 20,000 men in March, and in June it was made obligatory for all recruits, about 2,500 per month. Not until September 30, 1911, was the administration of the prophylactic made compulsory for all persons in the Army under 45 years of age. It was thus almost the end of the year before universal vaccination was introduced, yet it is estimated that about 55,000 had been immunized at the beginning of 1912. In the colonies the movement lagged somewhat, and the vaccination was probably not completed before July 1, 1912. It should also be noted that because of the large number of men in camps along the Mexican border the year 1911 was one of unusual exposure.

As a further illustration of the protective value of vaccination the following table modified from one by Col. Kean, of our corps (Jour. Amer. Med. Assoc., Aug. 26, 1911, 713), may be cited:

TABLE III.

	Number of troops.	Cases of typhoid.		Deaths, typhoid.	All deaths.
		Certain.	Certain and probably.		
Spanish War, camp at Jacksonville, Fla. (1898)	10,759	1,729	2,693	248	281
Camp at San Antonio, Tex. (1911)	12,801	1	.....	.....	1

The two divisions were encamped in nearly the same latitude and for about the same length of time; each had a good camp site and an artesian water supply of unimpeachable purity.

The general sanitation of the camp at San Antonio was vastly better than that of any of our camps in 1898, yet that alone does not explain the remarkable immunity to typhoid enjoyed by the troops, since they were not confined to the limits of the camp, but, from time to time, had leisure and opportunity to visit neighboring towns where the disease prevailed. During this period among the civil population, 49 cases of typhoid with 19 deaths were reported to the health officer of the city of San Antonio, Tex. Yet, in spite of exposure, no infections occurred among the troops other than the single one already mentioned. No matter how perfect field sanitation may be, it obviously will not protect troops against infection if they leave camp to eat, drink, and sleep, in fact, to become for a time a part of the community, where infectious diseases are endemic. Another and important possible source of infection was in the food supplies, which were, to a considerable extent, purchased in local markets. Lunch counters, hastily constructed restaurants, and venders sold edibles, pastry, sweets, and fruits in and along the outskirts of the camp. In brief, opportunities for infection were numerous; but only one case occurred, and we think it quite clearly demonstrated that the high degree of immunity possessed by the troops was due to vaccination.

For purposes of illustration it is customary when sufficient data can be obtained, to compare the typhoid rates among the inoculated with those among the untreated. It is impossible to give exact numbers of the vaccinated and unvaccinated, since the proportions were continually changing. The absolute number of the inoculated has of course constantly increased, but it is now believed that the following statement is conservative.

TABLE IV.—*Cases and deaths from typhoid fever from Jan. 1 to July 1, 1912.*

	Number.	Cases.	Ratio per 1,000.	Deaths.	Ratio per 1,000.
Persons vaccinated (estimated)	82,000	4	0.048	.....	.....
Persons not vaccinated	3,000	12	4.000	1	0.33

These statistics, collected as they are from a large number of men living in all parts of the United States and in our tropical and arctic colonies, cover a period of three years, and are sufficient to demonstrate clearly and forcibly the actual value of this means of prophylaxis against typhoid fever.

There is only one other disease of human beings with which we may compare this work in the prevention of typhoid, and that is smallpox. We know positively that when vaccination against smallpox is thoroughly carried out the disease disappears; we also know that the duration of the protection is not so long as our forefathers hoped. Instead of having one vaccination protect for life we now know that two or more are necessary. The English Royal Commission (Article "Vaccination," Encyclo. Britan., 11th ed.) believes the duration of the protection to be nine or ten years and that it is continually diminishing during this period. Kitasato (Jour. A. M. A., 1911, LVI, 889) writing on vaccination and smallpox in Japan, gives a table showing the degree of immunity remaining from year to year as tested by the percentage of successful vaccinations:

TABLE V.—*Successful revaccinations against smallpox, 951 cases.*

	Per cent.
After one year	13.6
After two years	32.9
After three years	46.6
After four years	57.3
After five years	51.1
After six years	63.8

In 1899 Weil (quoted by Kitasato) reported 72.5 per cent of successful revaccinations after 7 years, 80 per cent after 8 years, 85 per cent after 9 years, and 88.6 per cent after 10 years. Kitasato concludes that "the immunity acquired through vaccination begins to disappear during the second year, and by the tenth has almost completely disappeared." We have, in this, some definite facts regarding a successful prophylactic treatment for comparison with vaccination against typhoid fever. We do not yet know definitely the duration of the protection given by antityphoid vaccine, but from the rich experience of the British Army in India (Col. Firth, Jour. Roy. Army Med. Corps, 1911, XVI, 589) we learn that the immunity begins to diminish in about two and one-half years after inoculation; that is, at about the same time as after vaccinia. Col. Firth's tables also show that even after four or five years, the maximum period of observation, the rate among the inoculated is, roughly speaking, only one-fourth that of unprotected troops.

In the early days there was a tendency to consider that this immunity lasted little more than a year, since agglutinins disappear from the blood serum at about this time, yet we know that these antibodies are present as long after vaccination as after typhoid fever

itself, which confers, usually, protection for life. We are not, therefore, justified in concluding that the immunity ceases with the disappearance of the agglutinins and other antibodies. It remains to be seen if the immunity lasts as long as that conferred by vaccinia.

We also know that the immunity is not absolute, for in 1911 among about 80,000 persons vaccinated there were 12 cases of typhoid reported with 1 death due to intestinal hemorrhage, and in 1910 among 15,000 vaccinated there were 6 cases with no deaths. The diagnosis of typhoid was made purely on clinical grounds in many of these cases, and it is indeed perfectly possible, almost probable, that some were paratyphoid fever. During the past year we have seen an increasing number of cases and it may be more common than appears from our returns.

In India, Col. Firth (Jour. Roy. Army Med. Corps, 1912, XIX, 157) reports 104 cases of paratyphoid fever to 170 cases of typhoid during the year 1911, all based on accurate bacteriological diagnosis by means of blood cultures. This point is of considerable importance, as antityphoid vaccine does not protect in the least against paratyphoid fever.

The fact that the immunity is not absolute is, however, no objection to its use, but rather an argument for its repetition at intervals to be determined in the future as the lessons of experience become clear, just as we now do in the case of smallpox. The failure in some cases to secure absolute immunity may be due to inefficient vaccine, to exceptionally large quantities of infectious material, or to inability of the individual to respond to immunization with the usual antibodies, and this failure may be interpretated as a personal idiosyncrasy. With the limited number of doses of vaccine now used, we can never hope to raise the immunity high enough to protect against overwhelming doses of infectious material, and there are, no doubt, certain persons who can not be completely protected against typhoid any more than against smallpox.

We know that some persons can not be successfully protected against smallpox, just as some laboratory animals resist immunization. We know, for example, that not all horses can be profitably used for the production of diphtheria antitoxin.

The facts so far presented are sufficient to demonstrate that we have a simple, harmless, and effective method of protecting troops in the field against one of our worst enemies, typhoid fever.

While good results can be had by vaccinating volunteers, the full benefit of antityphoid vaccination can only be obtained by making it compulsory, for only in this way can both primary and secondary cases be reduced to a minimum.

We vaccinate every man immediately on enlistment or reenlistment, and in the event of mobilization of volunteers or the militia of several

States every man under 45 years of age would be inoculated as rapidly as fresh vaccine could be prepared and delivered in camp. We have shown that vaccination need not precede the departure of troops from the home stations but may safely be carried out in the field.

In the future no army should be ordered into the field in a region where typhoid fever is endemic unless every individual of the command has been immunized against the disease.

It is the only method of prophylaxis which protects the soldier against the ever-present bacillus carrier, and the only kind of protection which is effective under all conditions.

THE RESULTS OF ANTITYPHOID VACCINATION IN FOREIGN ARMIES.

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This paper is intended as a supplement to that of Maj. F. F. Russell, which has already been presented and which gives the results of antityphoid vaccination in the United States Army. It is the writer's purpose to review briefly the results obtained in foreign armies with the typhoid prophylactic so far as data are available. Unfortunately the literature dealing with this subject is very limited, with the exception of that relating to the employment of the prophylactic in the English Army, and therefore the data given may not do full justice to the results which have really been obtained in other armies.

So far as I have been able to ascertain, this method of prophylaxis against typhoid fever has been used in the armies of England, Germany, France, Japan, and the United States, and this paper will consider the results obtained in the armies of England, Germany, France, and Japan.

RESULTS IN THE ENGLISH ARMY IN INDIA AND AFRICA.

In 1898 Sir A. E. Wright first introduced prophylactic inoculation against typhoid fever in the English Army in India, and at this time about 4,000 men were inoculated. The results were considered most encouraging, and shortly afterwards, upon the outbreak of the Boer War, the method was introduced in the army serving in South Africa. The results obtained during this campaign were not as favorable as had been expected, due largely, according to Leishman, to overheating the prophylactic during its preparation, and its use was practically abandoned in the English Army from 1902 until 1904. At that time

Col. Sir William B. Leishman reestablished the method, and with an improved prophylactic the results have been uniformly good.

During the Boer War, Wright furnished over 400,000 doses of the prophylactic to the English Army, over 100,000 men being inoculated. Apparently the complete data covering these inoculations have never been published, but Wright [1] states that among 19,069 inoculated soldiers there occurred 226 cases of typhoid fever (11.84 cases per thousand of strength) and 39 deaths, a mortality of 17 per cent; while among 150,231 soldiers who did not receive the prophylactic there occurred 3,739 cases of typhoid fever (24.88 cases per 1,000), with a mortality of 25 per cent.

At Ladysmith [2] the following results were obtained:

	Number.	Morbidity.		Mortality.	
		Cases.	Per cent.	Deaths.	Per cent.
Vaccinated	1,705	35	2.05	8	0.47
Unvaccinated	10,529	1,489	14.14	329	3.13

At Modder River [3] there occurred 26 cases among 2,335 vaccinated, or 11.1 per cent, and 257 cases among 10,981 unvaccinated, or 23.4 per cent.

Wright considered that during this campaign the incidence of the disease was diminished about one-half and the mortality in a somewhat greater degree by the use of the typhoid prophylactic. These conclusions regarding the value of the inoculations during the Boer War have been seriously questioned, owing to unfavorable reports from certain commands, and it is generally admitted that the results were not nearly as favorable during this campaign as those which have since been obtained in the English and other armies.

Since the Boer War the preparation of the typhoid prophylactic for the English Army has been under the supervision of Col. Sir William B. Leishman, and the method has been used very extensively in the army in India. He [4] expresses it as his belief that the comparative lack of success with the prophylactic during the Boer War was due to overheating during its preparation, and he has shown experimentally that the prophylactic may be made much less efficient by heating at too high a temperature in killing the bacilli. Since 1904 he and others have published papers giving the results obtained in the English service in India, of which the following is a brief summary.

Leishman [5] gives the following figures covering the results obtained in the English Army in India up to July, 1910:

Among the vaccinated the number of cases of typhoid per 1,000 men was 5.39, while the mortality per 100 cases was 8.9. Among the unvaccinated the number of cases of typhoid per 1,000 men was 30.4, while the rate of mortality per 100 cases was 16.9.

Of 216,811 soldiers stationed in the English colonies and unvaccinated 4,677 developed typhoid fever, or 21.5 per 1,000; of this number 1,018 died, or 4.68 per 1,000 men. Of 28,110 vaccinated men 215 developed typhoid, or 7.29 per 1,000, and 34 died, or 1.20 per 1,000 men.

The following table, compiled by Maj. Russell [6] from Leishman's statistics, giving the results obtained in 24 regiments of English troops in India, the period of observation varying from four months to three and one-half years, is interesting as showing the protection afforded the inoculated:

Total strength:

At beginning of observation	18,433
At date of last report, August, 1909	19,314

	Inoculated.	Noninoculated.
Number at the beginning of observation	6,815	11,668
At date of last report	10,378	8,936
Cases of typhoid	56	272
Deaths from typhoid	5	46
Case incidence per 1,000	5.39	30.4
Case mortality per 100	8.9	16.9

Col. Leishman in 1909 [7] published the following table, giving the results in 16 units of the English Army in India:

Statistical table showing the results of antityphoid inoculation in 16 units of the army, up to June 1, 1908.

Unit.	Medical officer.	Station.	Inoculated.				Noninoculated.		
			Total strength (actual).	Number.	Cases.	Deaths.	Number.	Cases.	Deaths.
Second Royal Fusileers.	Capt. A. B. Smallman.	Trimulgherry	1,013	196	10	1	815	59	9
Seventeenth Lancers	Capt. E. J. Luxmore	Meerut	616	322	3	0	294	71	12
Brigade Royal Artillery.	Capt. E. G. Lithgow.	Pindi (from Transvaal).	370	60	0	0	310	7	0
Fourteenth Hussars.	Lieut. C. E. Fawcett	Bangalore	647	386	2	0	261	4	1
Second Dorsets	Lieut. E. G. Anthonisz.	Wellington	1,107	199	1	0	908	6	0
Third Coldstream Guards.	Lieut. J. H. Graham	Cairo	705	569	1	0	136	13	1
Second Leicesters	Lieut. H. S. Sherren.	Belgaum	963	346	3	1	617	17	1
First Connaught Rangers.	Lieut. A. D. O'Carrol.	Dagshai (from Malta).	483	300	0	0	183	2	1
Third Worcesters	Lieut. W. H. Forsyth.	Wynberg	900	220	0	0	680	3	0
First Dragoon Guards.	Lieut. G. H. Stevenson.	Umballa	592	450	0	0	142	0	0
First Yorks	Lieut. S. de C. O'Grady.	Cairo	893	470	0	0	423	0	0
First Suffolks	Lieut. J. B. G. Mulligan.	Malta	900	400	0	0	500	0	0
Third Royal Rifles	Lieut. R. W. D. Leslie.	Crete	879	190	0	0	689	0	0
Second Bedfords	Lieut. C. M. Drew	Gibraltar	700	320	0	0	380	3	1
Brigade Royal Artillery.	Lieut. A. S. Littlejohns.	Pretoria	375	247	1	0	128	2	0
First Lancers Fusiliers.	Lieut. F. D. G. Howell.	Chakrata	940	796	0	0	144	0	0
Total			12,083	5,473	21	2	6,610	187	26

Case Incidence per 1,000.

	Inoculated.	Noninoculated.
Among the whole of the above 16 units	3.8	28.3
Among the "exposed" units, i. e., in which cases of enteric occurred	6.6	39.5
"Exposed" units, less Royal Fusileers (the unit inoculated with the "old vaccine")	3.7	32.8

Summary.—There are only 4 cases among the above 21 which had received two doses of the new vaccine; all recovered. Three of the four had been noted as extremely mild, and the diagnosis of enteric in one of these is doubtful.

Col. R. H. Firth,[8] in a letter quoted by M. Netter at a meeting of the French Academy of Medicine, gave the following data regarding typhoid inoculation in the Indian Army in 1909.

	Vaccinated.	Unvaccinated.
Total number of soldiers	33,967	34,566
Number of cases of typhoid	158	481
Number of deaths	17	96
Proportion of cases per 1,000	4.7	13.9
Proportion of deaths per 1,000	0.6	2.6

The most recent figures from India are those reported by Col. Firth,[9] covering the first six months of the year 1911:

In that period there were, in all India, 112 cases of typhoid with 6 deaths among the protected men, and 45 cases with 4 deaths among the nonprotected. The protected population was 63,624 persons, and the nonprotected, 8,481. From these data we find the case incidence per thousand among the protected to be 1.7 and among the nonprotected to be 5.3. If we take the mortality and express it as per million, then the ratio for the protected is 94, and for the nonprotected, 471. That is to say, the incidence for typhoid for the first half year was, roughly, five times as great among the nonprotected as among the protected.

Although over 100,000 men have been inoculated in the English Army in India, no bad results have followed the inoculations, while, as shown by Col. Firth, the incidence of the disease is practically five times as great among the unprotected as among the protected and there is a proportional difference in the mortality.

The vaccine employed at the present time in the English Army is prepared from an old, nonvirulent strain of the typhoid bacillus grown in bouillon for 48 hours, and then killed by heating at 53° C. for one hour. Two inoculations are given, and the use of the prophylactic is purely voluntary in this army.

RESULTS IN THE GERMAN ARMY.

The only data I have been able to collect regarding the use of the typhoid prophylactic in the German Army is that relating to the troops employed in Southwest Africa during the Hereros campaign, lasting from 1904 to 1907. The vaccine used at this time was made accord-

ing to the method of Pfeiffer and Kolle. The bacilli were grown on auger slants and an emulsion made by adding 5 cubic centimeters of normal salt solution to each tube, after which the organisms were killed by heating the emulsion for an hour and a half or two hours at 60° C. Three inoculations were made, the doses being 1, 2, and 3 standard loopfuls of culture, or 2, 4, and 6 milligrams, the quantity contained in 0.5, 1, and 1.5 cubic centimeters of the finished vaccine. Experience showing that these doses were too large as proven by the severe general and local reactions, they were later reduced to 0.4, 0.8 and 1.2 cubic centimeters. The vaccination was voluntary, and about one-half of the troops volunteered.

The results obtained during this campaign have been published by Dr. Kuhn.[10] The troops numbered 16,496, and of this number 7,287 volunteered. There occurred 1,277 cases of typhoid among the uninoculated, the percentage being 9.84, while among the inoculated it was only 5.09, or about half that among the uninoculated. Kuhn gives the following table, showing that when the fever did occur among the inoculated it was of much milder type:

	Uninoculated.		Inoculated.	
	Number.	Per cent.	Number.	Per cent.
Light cases	331	36.55	186	50.13
Moderately severe	225	24.85	96	25.88
Severe	234	25.80	65	17.52
Fatal	116	12.80	24	6.47
		100.00		100.00

In addition it was clearly shown by Kuhn that nearly 60 per cent of the fatal cases in the inoculated occurred among those receiving only one dose; 33 per cent in those receiving two doses, while only a little over 8 per cent occurred among the men who had given three doses of the vaccine.

Maj. Russell [11] has briefly summarized the results obtained by the Germans in this campaign by saying that there was a reduction among the inoculated of one-half in the number of cases; a much higher percentage of light attacks, 50 to 36, and a much lower percentage of fatal cases, 6.4 to 12.8.

THE RESULTS IN THE FRENCH ARMY.

The data relating to the use of the typhoid prophylactic in the French Army are very limited, as it is only since 1911 that this method of protection has been used and, so far as the writer knows, only in the troops stationed in Morocco. Despite the great mass of evidence that has accumulated regarding the efficiency of this method of protection against typhoid fever, the French have been loath to adopt it in their

military service, but the results which have already been reported by Vincent [12] will undoubtedly convince the authorities that it should be adopted as a routine measure, just as it has been in our own service.

Vincent began his work among the soldiers in Morocco in August, 1911. The vaccines used consisted of three types—one prepared after the methods of Wright and Leishmann, one a polyvalent prophylactic prepared by mixing several strains of typhoid bacilli isolated in Morocco with para-typhoid bacilli A and B, and an antolysate of the polyvalent vaccine. His investigations cover a total of 3,065 men, from which were excluded 150 who had had a previous attack of typhoid, thus leaving 2,915 men. Of these, 283 were inoculated, while 2,632 remained uninoculated, the conditions of service and exposure being practically the same. Of the uninoculated, 116 per thousand had developed typhoid fever by November 1, 1911, and 8.35 per thousand had died. Of the inoculated, one had a very mild case of the disease and none died. Vincent publishes the following table giving the results obtained by him in Morocco:

Cases of typhoid among unvaccinated	171, or 64.97 per 1,000
Cases of typhoid among vaccinated	1, or 7.75 per 1,000
Deaths from typhoid among unvaccinated	22, or 8.35 per 1,000
Deaths from typhoid among vaccinated	0, or 0 per 1,000

In a more recent publication Vincent[13] reports that over 5,000 persons have been immunized against typhoid fever with his polyvalent prophylactic and that in no case have bad results been reported; that in the French Army operating in Morocco there did not develop a single case of typhoid fever in those inoculated with this vaccine while in the uninoculated living under the same conditions fever developed in over 14 per cent of the men.

RESULTS IN THE JAPANESE ARMY.

Very little data have been published regarding the results of the use of the typhoid vaccine in the Japanese Army. I have been informed by Maj. Inouye, of the Japanese war office, that this method of prophylaxis against typhoid has been in use in that army since 1909; that the vaccine used is one prepared from several strains of the typhoid bacillus and paratyphoid bacillus A and B, grown on agar; that three doses are administered, the first containing 500,000,000; the second 1,000,000,000, and the third 1,500,000,000 bacilli; that the prophylactic is administered once each year, as that is the enlistment period in the Japanese Army; and that the method is made obligatory by order from the war department. Maj. Inouye informed me that the results were most satisfactory, but the only published statistics that I have been able to find are those in the Sanitaets

Statistik der Japanischen Armee, Tokyo, which appeared in 1911. In this publication the following table is given, showing the results of this method of prophylaxis.

	Vaccinated.	Unvaccinated.
Total vaccinated	12,915	20,245
Cases of typhoid	13	293
Deaths from typhoid	1	49
Proportion of typhoid per 1,000	1	14.52
Proportion of deaths per 1,000	7.7	16.6

It will be noted that these statistics cover only about 30,000 men, which is a very small proportion of the Japanese Army. It is unfortunate that the statistics for the entire army are not published, but the small number reported upon shows conclusively the efficiency of this method of prophylaxis, as 64.97 per 1,000 of the uninoculated developed typhoid, while only 7.75 per 1,000 of the inoculated developed the disease.

CONCLUSION.

It must be evident to anyone who carefully considers the statistics given in this paper that antityphoid vaccination is a most efficient method of preventing the development of the disease in armies. The recent improvements in sanitation of camps and our great advances in the knowledge of the epidemiology of disease have been urged by the enemies of this measure as the chief reason for the decrease in the number of cases of typhoid, rather than the use of the prophylactic. While there can be no question that improved sanitation has operated in reducing typhoid in armies to a small extent during a very recent period, it can not be argued that the decrease in typhoid during the Boer War, during the Hereros campaign by the Germans, and during the occupation of Morocco by the French, was due to sanitary conditions, for it is well known that such conditions were no improvement upon those which obtained before the inception of typhoid prophylaxis. Again, the vast difference in the number of cases of the disease and in the rate of mortality between the inoculated and uninoculated is decisive proof of the efficiency of the method, for the statistics deal largely with men surrounded by identical sanitary conditions and living in close contact with one another, often in the same tent. Only one conclusion can be reached after a consideration of all the factors relating to this subject, and that is, that antityphoid inoculation has proven its value in every army in which it has been given a thorough trial, and that to it alone should be credited most of the improvement in the morbidity and mortality of typhoid in these armies.

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AN ANALYSIS OF ANTITYPHOID VACCINES AND A CONSIDERATION OF THEIR RELATIVE PRACTICAL VALUE AT THE PRESENT TIME.

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If we enumerate the various vaccines which have been proposed during the last 25 years for the purpose of immunizing human beings against typhoid, we find, according to Friedberger's[1] résumé of 1908, no less than 15 fairly distinct products, and several additional ones have been developed since that time. These vaccines vary all the way from the living typhoid bacillus itself to minute fractions of the organism; all are supported by more or less experimental evidence and each one reflects the views of its author on the nature of the disease and of the immunity produced by it. In attempting to orient ourselves among so many products we may start with the fundamental fact that a natural attack of typhoid confers immunity in the great majority of cases. According to different authors, this immunity is effective in 95 to 99 per cent of persons. As a basis for attempts at artificial immunization this fact outweighs any immunity produced in animals or the presence of any protective bodies in the body fluids of man and is independent of any theory of immunity. In fact we may also state that there is no general agreement, as yet, in regard to the nature of the immunity produced by an attack of the disease or by vaccination.

With this clinical fact as a start we may lay down certain requirements which a vaccine must fulfill according to common consent.

1. It must be safe to take and to handle. We must be able to give assurance that a vaccine can do no harm to a person in ordinary good health before we can expect to see it adopted generally. The

imaginary "negative phase" has already retarded antityphoid vaccination, and any accidental infection with typhoid or with any other disease would undoubtedly seriously interfere with progress.

2. The final test of its value must of course be protection of man against the disease. No amount of laboratory evidence is worth as much as the actual absence of typhoid among large numbers of vaccinated individuals and its presence among the unvaccinated living under the same conditions.

3. Other things being equal, relative ease of manufacture and cheapness are additional advantages because to be really effective in an epidemic disease like typhoid, a vaccine must be available in large quantities in all parts of the world.

By weighing the various vaccines according to these conditions we can reach some conclusion concerning their relative practical value at the present time. This does not of course mean that the most practical vaccine available at present is the best one possible. Some valuable evidence can also be obtained by considering the results obtained so far in attempts to vaccinate against cholera and plague. Although these diseases, especially cholera, differ in nature from typhoid, there is a striking similarity in the vaccines which have been used for protection and many practical problems of vaccination are the same in the three diseases.

When Metchnikoff and Besredka[2] showed that chimpanzees were susceptible to a typhoid fever which approximated the human disease it was generally hoped that some definite experimental evidence of the value of vaccines could be obtained which would be more conclusive than experiments with lower animals, the demonstration of antibodies in man, or the results of ambiguous statistics. According to these authors their experiments showed that killed cultures and their products were useless and that living cultures alone protected. Without going into a critical examination of these experiments, it may be said that they have not settled the question because, almost at the same time, new and conclusive evidence of the protective value of killed cultures for man has been produced in the American Army, as has been shown in a preceding paper by Major Russell. The same situation is met on many aspects of the subject. On the one hand we have a large amount of experimental evidence in regard to the best possible vaccine, and on the other hand we have strong evidence as outlined in the two preceding papers, of the actual value of one form of vaccine which has been used on a large scale, but which, on several theoretical grounds, might be improved. In our endeavor to prove all things but to hold fast that which is good, we must recognize that we have, in whole killed cultures, a vaccine of demonstrated value. According to our experiences in the American Army the results at present seem to be as good as could be expected;

if these results continue, the subject will be settled as far as we are concerned. If they do not continue—and at least two observers in other parts of the world, Castellani and Vincent, have claimed that whole killed cultures are less effective than their own vaccines—then the question of improvement must of course still be open.

I. LIVING VACCINES.

The nearest approach to the natural disease lies of course in the use of living cultures. No one has proposed the use of unmodified living cultures, and it is probable that the subcutaneous injection of such a vaccine would produce the disease itself. At any rate, in one of Metchnikoff and Besredka's experiments on chimpanzees a long fever was set up by subcutaneous injection of living bacilli, and while no organisms were found in one blood culture, the fever curve very much resembled that of the controls which had a typhoid septicemia.

Modified living vaccines have been proposed by Castellani and by Metchnikoff and Besredka. Castellani [3] uses 24-hour broth cultures, heated to 50° for one hour. Some of the bacilli remain alive as they grow on agar. The body reaction is more marked than with dead cultures, but the immunity—judged by agglutination—is more marked, and among 106 persons vaccinated with dead cultures 3 cases of typhoid occurred, while among 310 vaccinated with living organisms, or once with dead and once with living organisms, no cases occurred in an endemic area during an observation period running from months to years. Castellani concludes that the vaccine is not dangerous in the way of producing carriers and is more effective in actual protection.

Metchnikoff and Besredka experimented on chimpanzees with a living sensitized culture prepared by washing a 24-hour agar culture with 1 cubic centimeter NaCl solution, adding 10 drops of antityphoid serum and allowing contact for 5 hours, then centrifuging and taking up the sediment in 10 cubic centimeters NaCl solution. On injection into guinea pigs the sensitized culture is four times less virulent than the untreated culture. This vaccine protected chimpanzees, while Vincent's killed cultures and autolysates failed to do so. Two patients were inoculated by Metchnikoff and Besredka, and a larger number of inoculations has recently been reported on by Broughton-Alcock [4] as follows: The bacilli remain alive for over four months; there is no general reaction and only an insignificant local reaction; the serum, after vaccination, does not deviate complement and rarely agglutinates, but the blood shows an increase in phagocytic power.

Vincent has advocated an autolysate of living cultures which will be considered later.

Applying our requirements to the living vaccines, it appears safe to take these attenuated vaccines subcutaneously, but there is still a question if they are safe to handle and whether they might not accidentally infect persons by mouth. We know that freezing does not render the bacillus innocuous by mouth, and the same may be true of heating short of the death point and also of sensitization. This point might be possibly settled by experiments on chimpanzees. Another objection is the possibility of contamination. This is not theoretical, as it has occurred twice in the history of cholera vaccination with disastrous effects upon the progress of the movement. Contamination of a killed vaccine can be absolutely ruled out at the time of manufacture, and enough antiseptic can be added without damage to prevent future accidental contamination. Living vaccines can never be made and handled with this confidence, and this circumstance remains a serious objection to the use of such vaccines on a large scale.

Protection.—No data are as yet available in regard to the protection afforded in man by the vaccine of Metchnikoff and Besredka. Castellani's figures are small, but as far as they go are favorable to the living vaccine. It is a question, however, whether better results with the killed cultures might not have been obtained by three injections of the vaccine used in the English and American armies. Advocates of the use of living cultures usually assume that killed cultures have been more or less of a failure; but this is not the case, at least, in the American Army. Here, as was said above, the results have been practically as good as could be expected, and if they continue there can be no question of the use of living cultures with their possibilities of harm. If, however, further experience shows that the protection afforded by the best form of killed cultures is inferior to that given by living cultures, then the latter should be given priority for small numbers of people who can be treated under the supervision of the laboratory which makes the vaccine. But for use at a distance and under all sorts of conditions the danger of contamination would still be a serious if not a conclusive objection.

Ease of manufacture.—Castellani uses 24-hour cultures, and no data are given in regard to the keeping qualities of the vaccine. Further information on this point is evidently necessary. The vaccine of Metchnikoff and Besredka apparently keeps for at least four months. But the technique is somewhat complicated and the additional labor would only be justified by the clear superiority of results. These are yet to be supplied.

In both cholera and plague vaccination an effort has been made to use attenuated living cultures; in cholera, accidental contamination with tetanus and with plague organisms have done much to discredit their use, and in plague this method is still on trial. Theo-

retically and experimentally, there seem to be advantages in the use of living attenuated cultures, but their practical and safe use on a large scale has not yet been shown to be possible.

II. KILLED CULTURES.

The principles of ordinary vaccine therapy are so well known and killed cultures of so many organisms have been so widely used that we may say at once that vaccines made of killed cultures are safe to use and that they are reasonably easy to prepare. The protection afforded by these vaccines has already been considered in the preceding papers. The questions which arise here are the choice of the strain, the culture media, the nature of the agent used for killing the culture, and the number of doses.

The two principal vaccines used are, of course, the Wright-Leishmann 48-hour broth culture, killed at 53°, and the Kolle and Pfeiffer 24-hour agar culture, killed at 60°. The vaccine used in the American Army is a composite of those two vaccines; agar cultures are used and are killed at 53° to 54°. A detailed account of the method of preparation is given in an appendix to this paper.

In regard to the strain used the first consideration would naturally be its immunizing power. As far as can be judged by the production of antibodies and this is only a partial test, but the best we have for experimental purposes, a virulent culture has no advantage over an avirulent one. In addition, a freshly isolated, virulent organism seems to give more severe local reactions. As a matter of fact the organism used in the English and American armies was selected, according to Leishmann,[5] because it gave an even emulsion when grown on agar rather than for any other reason, and in the most extensive use of any vaccine has afforded substantial protection. This strain was isolated from the spleen of a patient at Netley in 1900 and is avirulent—one whole agar culture given intraperitoneally does not kill a guinea pig. The selection of this strain must be considered a fortunate one in view of the success of this vaccine and the apparent unsuitableness of several other strains. On several grounds a polyvalent vaccine would seem to possess advantages, but most of the favorable evidence to date has been obtained with a single strain. Improvement may possibly come in this direction, but a monovalent vaccine has been given a thorough trial and as was said above the result in the American Army has so far been entirely satisfactory.

In regard to culture media we feel that agar is superior to broth. (1) Contaminations are more easily detected; (2) the actual labor of the manufacture is less; (3) no peptone or extraneous substances are injected.

In regard to the agent used for killing the data is mostly experimental, although Leishmann believes that some of the bad results in the Boer War were due to overheating. At the same time some vaccines which have been prepared by heating to over 100°, in the dry state, still possess marked antigenic properties; at all events, the thermal death point of the typhoid bacillus is 53° to 55° for one hour and it seems unnecessary to go over this degree of heat. In regard to killing by chemicals, experiments on animals by Russell [6] have failed to show that phenol, formalin, etc., are superior to heat.

Dosage.—The number of injections seems to have depended largely on the practical question of how many people would take. The old idea was that people would submit to only one application as in case of smallpox vaccine, but now that the value of several injections is realized no serious objection is raised to carrying out the doctor's advise and at least three injections are entirely feasible. It seems to be true that immunity depends on the number of injections and that three injections are certainly more effective than two.

On considering the results of attempts at vaccination against plague we find, in the Report of International Plague Conference held at Mukden, 1912,[7] the following statements: "It is the opinion of the majority of the conference that killed cultures represent at the present time the simplest, safest, and best method of vaccination against plague."

A great deal of experimental work has been done on other forms of vaccines made of killed cultures—such as sensitized dead cultures, dried and powdered cultures, etc., but, on account of the lack of practical use, these vaccines will not be considered in this paper.

III. BACILLARY FRACTIONS.

Various fractions of the bacillus have been proposed, and as our knowledge increases it is not at all unlikely that practical progress may be made in this direction. Just as diphtheria antitoxin is now purified from indifferent parts of the serum, so we may come eventually to use only the immunizing fraction of the bacillus. A large number of modifications come under this heading, but with the exception of Vincent's autolysate, none have been given much practical trial.

Vincent [8] has reported favorable results from an autolysate made of a mixture of living, recently isolated strains. It is difficult to see what especial virtue there is in the use of living cultures, as an organism must die before it autolyzes and the typhoid bacillus has no soluble toxin, but the practical use of such a vaccine commands attention. Vincent, working with guinea pigs, given three vaccinations and then given a virulent culture intraperitoneally and several cubic centimeters of a 10 per cent NaCl solution subcutaneously,

found that living cultures and killed cultures protected and that an autolysate of living cultures was also effective. His vaccine is made as follows: Several strains isolated from the neighborhood in which the vaccine is to be used are grown on agar 24 to 48 hours; the growth is taken up in salt solution and kept at 37° for 2 to 4 days; after centrifugation, the supernatant fluid is sterilized by being shaken with ether which is then allowed to evaporate. Three or four injections are given. Vincent reports the following results from Algeria:

Not vaccinated	2,632	171 cases, 64 per 1,000.
Vaccine of Wright	129	1 case, 7 per 1,000.
Vaccine bacillary polyvalent	81	0 case, 0 per 1,000.
Autolysate polyvalent	73	0 case, 0 per 1,000.

The Wright vaccine was made with strain R supplied by Colonel Leishmann. The comparison with a vaccine made of strain R is to be commended, as this is the best standard for vaccines made from killed cultures. The figures, however, are entirely too small for comparative purposes and are simply suggestive of possibilities which for the present remain as possibilities.

Among the many fractions proposed, Vaughn's "residue" may be especially mentioned as it specifically raises the question of the difference between the toxic and immunizing parts of the bacillus. In Vaughn's [9] procedure, massive growths are treated with 2 per cent NaOH in absolute alcohol at 78°, and the insoluble residue is evaporated and used as a powder. According to Vaughn, this residue, which represents about two-thirds of the body of the bacilli, is the immunizing fraction; it is nontoxic and keeps indefinitely.

On the other hand, Pfeiffer and Bessau [10] have recently published a paper on "The supposed separation of the toxic and immunizing fractions of the typhoid bacillus," in which they state that the toxic and immunizing fractions are identical and that any vaccine based on their supposed separation is wrong in principle. According to these authors the toxic and immunizing parts of the bacillus pass into solution by simply heating at 58° for one hour and the remaining bodies have no immunizing power. If this is true it is evidently unnecessary to inject the whole or two-thirds of the bacillus. But evidence from animal and test tube experiments is evidently not sufficient to settle these points and practical work in these directions is greatly to be desired. This is increasingly difficult to obtain, however, in the face of the excellent results obtained from whole killed cultures.

PERSONAL OBSERVATIONS.

In order to obtain some additional information on disputed points I have carried out several preliminary experiments. First the question of recently isolated strains was considered. Five strains isolated within four months were compared with the Kolle-Pfeiffer and Leish-

mann strains in the production of agglutinins. Rabbits were given 0.5 cubic centimeter subcutaneously and two dozes of 1 cubic centimeter intravenously at 10-day intervals and their sera were tested 10 days after the last injection, with the following results:

TABLE 1.

	1-2,000.	4,000.	8,000.	16,000.	32,000.	64,000.
11. From feces	+	+−	−	−	−	−
12. From feces	+	+−	−	−	−	−
13. From blood	+	+	−	−	−	−
14. From feces	+	−	−	−	−	−
15. From blood	+	+	+−	−	−	−
"151" Kolle-Pfeiffer	+	+	+	−	−	−
R (Leishmann)	+	+	+	+	+−	−

None of these strains agglutinated with its own serum as well as strain R. Further tests also showed that R agglutinated better than any of these strains with their own sera except in the case of 15. It is recognized that agglutinins are not generally regarded as important defensive antibodies because, in some instances, agglutinins have not run parallel with bactericidins. But the fact remains that strain R, which has produced the most solid immunity against typhoid in actual case rates, has a very high agglutinogen content. Each lot of our vaccine is tested for agglutinogen on rabbits and, after two injections, the average agglutination of the last 20 lots was 1–18,000.

In a second experiment, similar tests were made on various filtrates prepared without heat.

TABLE 2.

	1-2,000.	4,000.	8,000.	16,000.	32,000.	64,000.
1	−	−	−	−	−	−
2	+	+	−	−	−	−
3	+	+	+	+	−	−
5	+	+	+−	−	−	−
6	+	+	+−	−	−	−
Control	+	+	+	+	+	.....

(1) Vaccine made as usual but without heating; 24 hours at 37°; tricresol added; shaken 24 hours; filtered through Berkfeld candle "W." Agg. +, 1–200; +, 1–400; −, 1–800.
(2) Same as (1) but kept at 20° for 3 days.
(3) Same as (1) but kept at 40° for 4 days.
(5) Same as (1) but kept at 37° for 1 week.
(6) Same as (5) but tricresol added before autolysis.
Control, same vaccine made in usual way.

These results show that a considerable amount of agglutinogen goes into solution under various conditions, but they also show that this amount is far below the maximum seen in the control. No difference was found between the autolysates of living and dead organisms (5 and 6).

In a third experiment, filtrates were tested after killing by heat. Our vaccine is now killed at 53°–54° for one hour, and the filtrate of the regular vaccine was first used. In rabbits this filtrate produced

a serum agglutinating to 1–12,000, but in man the results were much less satisfactory. Twelve students were given the filtrate in usual doses of 0.5 and 1 cubic centimeter at weekly intervals, and their sera were tested one week after the last dose. The highest agglutinations in each case are given below and, for comparison, the highest agglutinations produced in 12 students with the regular vaccine are also given.

TABLE 3.

	Filtrate.	Whole vaccine.
1	.....	1–2,560
2	.....	5,120
3	1–100	10,240
4	100	10,240
5	100	16,000
6	100	16,000
7	200	16,000
8	200	16,000
9	400	16,000
10	400	16,000
11	800	16,000
12	1,600	20,480

It is seen that, as far as agglutinins are concerned, this filtrate does not promise much.

The first set of students were then given two doses of the regular vaccine, and the local and general reactions of the filtrate and whole vaccine were compared. The local reactions were nearly the same, but the constitutional reactions were somewhat more marked with the whole killed culture, as may be seen in the following table:

TABLE 4.

	Filtrate (42 injections).	Whole vaccine (26 injections).
	Per cent.	*Per cent.*
Reaction in arm	71	73
Fever	11	18
Headache, etc.	26	30

This evidence, as far as it goes, seems to support the contention of Pfeiffer and Bessau that the toxic part of the bacillus tends to pass into solution on heating, but whether it all passes into solution and whether the toxic portion is entirely identical with the immunizing portion is not so clear.

Some light is thrown on these questions by the fatal dose for rabbits of the whole vaccine and of various fractions, as is shown in the following table. The amounts given are in cubic centimeters per kilo, intravenously.

TABLE 5.

	Whole vaccine.	Filtrate.	Supernatant fluid.	Centrifugate.
No. 109, killed at 53°-54°, 1 hour.	2 cubic centimeters, negative.	.....	2 cubic centimeters, negative.	
	3 cubic centimeters, very sick, killed, 48 hours.	.....	3 cubic centimeters, dead, 24 hours.	3 cubic centimeters negative.
	.....	4 cubic centimeters, sick, recovered.	.....	
	.....	5 cubic centimeters, sick, recovered.	.....	
	3 cubic centimeters, dead, 24 hours.	.....	3 cubic centimeters, very sick, killed, 72 hours.	
No. 58, killed at 58°, 1 hour.	4 cubic centimeters, very sick, killed, 48 hours.	4 cubic centimeters, sick, recovered.	4 cubic centimeters, dead, 24 hours.	4 cubic centimeters, negative.
	.....	5 cubic centimeters, negative.	.....	5 cubic centimeters, sick, recovered.
	.....	.....	.....	5 cubic centimeters, dead, 24 hours.
	.....	6 cubic centimeters, sick, recovered.		6 cubic centimeters, sick, recovered.

It will be seen that after 3 cubic centimeters per kilo of the regular vaccine the animal was so sick that it was killed after 48 hours. A number of other experiments with various doses and different lots of vaccine have shown that the fatal dose lies between 2 to 4 cubic centimeters per kilo, depending on the resistance of the animal. The supernatant fluid after centrifugation produces practically the same results as the whole vaccine. This fluid, however, is not perfectly clear even after 12 hours centrifugation at high speed, and contains disintegrated bodies of the bacilli. This is fluid used by Pfeiffer and Bessau. The clear filtrate has considerably less toxic power in both instances. The centrifugate is also less toxic, but has not lost all its toxicity, as it killed in one instance, in a dose of 5 cubic centimeters per kilo. On washing the centrifugate with salt solution and centrifuging again the supernatant fluid becomes perfectly clear, thus differing from the first centrifugation. The centrifugate produced agglutinins up to 1 to 6,400. Assuming that agglutinins have something to do with immunity, we are not prepared to admit that any fraction is as valuable as the whole vaccine.

Summarizing these findings, we find that, as far as the evidence goes, and it is admittedly incomplete, there is no clear indication for the use of freshly isolated cultures or of filtrates or other fractions of the vaccine which were used.

CONCLUSION.

In conclusion, we see that only three vaccines come into consideration from the point of view of the results of practical use at the present time—attenuated living cultures, killed cultures, and autolysates—and the great bulk of favorable evidence comes from the use of killed cultures. Apparently insuperable objections seem to exist

against the use of a living vaccine on a large scale, and the only possible direction of improvement seems to lie in the way of bacillary fractions. A great deal of practical evidence will be necessary before it can be decided whether filtrates, or other fractions, offer any real advantages.

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DIRECTIONS FOR MAKING TYPHOID PROPHYLACTIC.

ARMY MEDICAL SCHOOL,
Washington, D. C., January 1, 1912.

CULTURE.

1. Plate Rawling's culture on at least two sets of plates; incubate 48 hours.
2. Examine colonies with low power of microscope and mark 10 which have typical morphology and are large and well separated.
3. From each colony make a transfer to two tubes, (1) a massive agar slant, (2) a stab and slant of double sugar. Keep corresponding tubes together; incubate 24 hours.
4. Examine growth and make microscopic agglutinations, 1–200, from each typical double sugar tube.
5. Select agar slants which correspond to the double sugar cultures giving positive agglutinations. Add 3 to 4 cubic centimeters of bouillon to each slant; scrape off growth and collect the emulsion in two large test tubes. Let these stand at room temperature over night.
6. From each tube make a Gram stain of a heavy smear. Gram positive, spore-bearing organisms have been found a few times.

Media and salt solution.

1. Make 8 to 10 liters 3 per cent agar, slightly alkaline to litmus or +1.0, to phenolphthalein.
2. Sterilize 80 to 100 Kolle flasks with dry heat, plug with absorbent cotton, and reheat to set plugs.
3. Put 80 to 100 cubic centimeters of agar in each flask, make basket of tubes for massive slants and sterilize flasks and tubes in autoclave at 15 pounds for 1 hour.
4. Let agar harden overnight with flasks flat. Invert flasks and place them in incubator on slight slant for 24 to 48 hours at 37.5°. Open incubator for 24 to 48 hours.

5. Make 30 liters 0.85 per cent NaCl, autoclave on two days, at 15 pounds, 1½ hours. Plate several cubic centimeters from 6 to 10 flasks. Incubate plates 24 to 48 hours.

6. Make 6 absorbent cotton swabs on wire rods; put in test tubes and sterilize in autoclave.

VACCINE.

1. Examine each flask for sterility, flame plug and remove plug and flame mouth of flask; infected flasks are found very rarely.

2. Inoculate each flask twice with well-charged swab from a tube of emulsion, avoiding water of condensation. Invert on slant and incubate 24 hours. Make plate cultures from emulsion which is left. Contaminations of this emulsion are rare.

3. Examine each flask with great care and discard any flasks which have growths not typical of a typhoid culture or show Gram positive organisms on staining. This is the most important step in the procedure because if any spore-bearing organisms are passed over and get into the vaccine they will not be killed by subsequent measures and the vaccine will not be sterile; hence the inoculation room must be kept free from dust and disturbance during inoculation.

4. Examine plates of salt solution. These are rarely found infected. Add 30 to 50 cubic centimeters salt solution to each flask; place on slight slant so that salt solution will moisten growth for few minutes; scrape off growth and collect in large flasks; total quantity is usually about 4 liters.

5. Mix collections and take sample for counting. The counts usually approximat 5,000,000,000 per cubic centimeter.

6. Pour emulsion into four 1-liter flasks, put tinfoil on plug, and weight with lead and put in two baskets. One basket should contain control flask with salt solution and thermometer. The water should cover the body of the flasks by 1 to 2 inches.

7. Kill emulsion at 53 to 54° for one hour in well-mixed water bath.

8. Measure emulsion. Take sample for culture.

9. Add tricresol to diluting fluid, about 3 cubic centimeters to a liter, so that the final amount will be 0.25 per cent. Dilute vaccine according to count in large sterile bottles. The tricresol should be entirely in solution before adding to vaccine. With a good growth and with addition of about 50 cubic centimeters NaCl to a flask the count should be nearly even and give about 250 cubic centimeters vaccine per flask or about 20 liters for 80 flasks.

10. After 2 to 24 hours take sample for culture.

Tests.

1. Plate 2 large loopfuls of emulsion left from inoculation on 2 sets of plates. Contaminations are rarely found.

2. Plate 1 cubic centimeter killed vaccine in each of 3 plates. These plates should show some colonies of typhoid, but no others.

3. Plate 2 cubic centimeters cresolized vaccine in each of 3 plates and 2 anaerobic tubes. These plates and tubes should be sterile. If not, the vaccine must be discarded. The most frequent cause of rejection of vaccines (10 per cent) is the presence of a few spore-bearing air organisms in these plates.

4. Inoculate animals if above tests are satisfactory: Guinea pig, 1.5 intraperitoneally; white mouse, 0.5 subcutaneously; rabbit, 0.5 subcutaneously; after 10 days, 1 c. c. intravenously, test agglutination; after 10 days, 1 c. c. intravenously, test agglutination.

Final agglutination should run to 1 to 10,000 dilution. Guinea pigs and rabbits sometimes die of intercurrent disease and must be reinoculated. The mouse is used to test the effect of the antiseptic, as a mouse will die if antiseptic is over 0.5 per cent. The mouse with the guinea pig is also used as a test for tetanus. The rabbit is used as a test for agglutinating purposes. One vaccine has been discarded as it did not produce good agglutination. No vaccine has been discarded for toxicity or tetanus or other

causes as a result of animal inoculation. If the animals are in good condition at the end of a week the vaccine is released for bottling. Good agglutinations are so constant that the vaccine is not held for these results.

If the vaccine is started on Monday it can be finished on Saturday and 20 to 25 liters can be easily made a week; if necessary, two batches a week can be made.

After bottling, several cubic centimeters from several different ampules are tested anaerobically and aerobically. If these tests are sterile the ampules may be issued. The vaccine is not to be used after four months from time of manufacture.

Example of records.

[Number, 108; date made, July 26, 1912; amount, 18,000 cubic centimeters; time limit. Dec. 1, 1912; released, Aug. 3, 1912.]

Culture.		
1. Date culture plated out; date transfers made	July 21	July 23; 10 colonies.
2. Date tests satisfactory	July 24	9 tubes; 1 did not agglutinate.
3. Date emulsion made	do	
4. Date emulsion pure by Gram's stain	July 25	Yes.
5. Date emulsion pure by plating	July 26	Yes.
AGAR AND SALT SOLUTION.		
1. Date agar made, number of flasks	July 21	104.
2. Date agar sterile, days incubation	July 25	4.
3. Date result of culture of salt solution	July 26	Sterile.
VACCINE.		
1. Date inoculation, number of flasks	July 25	102; 2 broken.
2. Date vaccine made, number of flasks	July 26	92; 10 rejected, cracked; 8 examined by Gram; all pure.
3. Count is	500 cells, 450 bacteria.	
4. Killed at—for	53°-54°	1 hour.
5. Quantity of emulsion	4,000 cubic centimeters.	
6. Quantity of salt solution added	14,000 cubic centimeters.	
7. Quantity of vaccine	18,000 cubic centimeters.	
8. Number of bottles	3	
TESTS.		
1. Result of culture of killed vaccine	50–100 colonies of typhoid per cubic centimeter.	July 27.
2. Result of culture of cresolozed vaccine	Sterile	July 27–28.
Aerobic	12 cubic centimeters, H. J. N.	
Anaerobic		
3. Result of culture of bottled vaccine	Sterile	Aug. 8.
Aerobic	30 cubic centimeters, Davis.	
Anaerobic		

	Date.	Quantity.	Result.
4. Animal inoculation and results:			
Guinea pig	July 27, 1912	1.5 cubic centimeters intraperitoneally.	Aug. 3; well.
Mouse	do	0.5 cubic centimeters subcutaneously.	Do.
Rabbit	do	do	Do.
	Aug. 7, 1912	1 cubic centimeter intravenously.	Agglutination, 1–10,000.
	Aug. 18, 1912	do	Agglutination, 1–20,000.

VERBREITUNG DER ÜBERTRAGBAREN KRANKHEITEN IN DEN EUROPÄISCHEN HEEREN UND NEUERE FORTSCHRITTE IN DER BEKÄMPFUNG DIESER KRANKHEITEN.

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Demonstration von Lichtbildern, statistische Angaben nach dem Durchschnitt der fünf letzten Berichtjahre. Ausführliche Mitteilung wird anderweitig veröffentlicht.

TYPHUSENTSTEHUNG UND TYPHUSVERHÜTUNG.

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Bei der organisierten Typhusbekämpfung im Südwesten Deutschlands hatte ich Gelegenheit über 11,000 Typhus- und Paratyphusfälle zu bearbeiten. Die hierbei gewonnenen Erfahrungen sollen in der demnächst zu veröffentlichenden Typhusdenkschrift des Kaiserlichen Gesundheitsamts ausführlich besprochen werden. Es sei mir gestattet, an dieser Stelle nur einige besonders bemerkenswerte Beobachtungen daraus hervorzuheben.

In der Zeit von 1904 bis Ende 1909 sank die Typhusmorbidität von 11.3 auf 4.88 pro 10,000 Einwohner, die Abnahme betrug also 58 Prozent. In anderen Gegenden Deutschlands wurde zwar auch eine Abnahme der Typhusfrequenz beobachtet, jedoch erreichte sie nirgends einen so hohen Grad wie im Gebiet der organisierten Typhusbekämpfung.

Die schon längst bekannte Vorliebe des Typhus für Industriegegenden kam im Südwesten Deutschlands darin zum Ausdruck, dass 55 Prozent aller Typhusfälle bei in der Industrie beschäftigten Personen und nur 20 Prozent bei in der Landwirtschaft tätigen Personen auftraten, dass ferner industrielle Kreise, wie Saargemünd und Diedenhofen eine Morbidität von 18.3 und 15.8 aufwiesen, während in ländlichen Kreisen, wie Erstein und Chateau-Salins von je 10,000 Einwohnern nur 3 bz. 4 erkrankten. Diesen Verhältnissen entspricht auch die interessante Tatsache, dass in industriellen Kreisen 65–67 Prozent, in ländlichen Kreisen aber nur 22–25 Prozent aller vorhandener Ortschaften von Typhus heimgesucht wurden. Mit dem Sinken der Typhusmorbidität ist auch die Zahl der Typhusortschaften während der genannten Jahre entsprechend zurückgegangen, nämlich um 54 Prozent. Das ebenfalls schon bekannte Haften des Typhus an dem einmal befallenen Ort zeigte sich an unserem Material u. a. darin, dass alljährlich nur eine verschwindend kleine Zahl von solchen Ortschaften neu mit Typhus heimgesucht wurde, die bis dahin von Typhus frei gewesen waren. Auf diese Bodenständigkeit des Typhus ist ferner die Tatsache zurückzuführen, dass trotz der starken Durchssuchung der Gegend doch 57 Prozent

aller Ortschaften in den genannten Jahren von Typhus freigeblieben sind. Nach den bisherigen langjährigen Erfahrungen werden sie es mit wenigen Ausnahmen auch fernerhin bleiben.

Eine wirksame Typhusbekämpfung wird also ihre Aufmerksamkeit zunächst auf diese Typhusorte richten und die anderen Ortschaften vorläufig vernachlässigen müssen, in denen der Typhus nicht, wie in den Typhusorten gesetzmässig entsteht, sondern nur durch Zufall hineingetragen wird.

Man muss vor allem den Ursprung dieser endogenen Typhusfälle auf zudecken suchen, stösst aber dabei sofort auf die grosse und bisher nicht genügend berücksichtigte Schwierigkeit, dass überhaupt nur bei höchstens der Hälfte aller Typhuserkrankungen die Ansteckungsquelle mit einiger Wahrscheinlichkeit festzustellen ist. Dies trifft nicht nur für die Typhusbekämpfung im Südwesten Deutschlands, sondern auch für die in Washington zu, wie aus den musterhaften Berichten von Anderson, Rosenau, Lumbsten und Kastle hervorgeht. In anderen Gegenden, ohne organisierte Typhusbekämpfung bleibt sogar der Ursprung von drei viertel aller Typhuserkrankungen dauernd im Dunkel.

Auf diese unaufklärten Fälle werden wir gleich noch näher einzugehen haben, zunächst sei aber die Tatsache mitgeteilt, dass von den 962 Fällen des Jahres 1909 57 Prozent einigermassen ätiologisch aufgeklärt werden konnten, und dass von diesen wiederum nur 13 Prozent durch Wasser, 7 Prozent durch Milch, 3 Prozent durch andere Nahrungsmittel, 5 Prozent durch Einschleppung, aber 67 Prozent durch andere Typhuskranke oder Bazillenträger hervorgerufen waren. Wir bezeichnen diese Fälle als Kontaktfälle und wollen damit nur die überaus wichtige Tatsache hervorheben, dass der Ursprung dieser Krankheitsfälle in dem Umgang mit anderen, typhusbazillenausscheidenden Menschen zu suchen ist. Wie im einzelnen diese Uebertragung von Mensch zu Mensch vor sich gegangen ist, ob unmittelbar von Hand zu Hand oder durch die Vermittlung irgendwelcher Gegenstände, ist unwesentlich. Kehren wir jetzt zu den unaufgeklärten Fällen zurück; ist es nicht von vornherein am wahrscheinlichsten, dass auch bei ihnen die allermeisten Erkrankungen vom typhusbazillenausscheidenden Menschen ausgehen? Von Nahrungsmitteln und Gebrauchsgegenständen kämen ja nur solche in Betracht, die der grossen Masse zur Verfügung stehen und diese würden bei der lebhaften dauernd auf sie gerichteten Aufmerksamkeit in einem Typhusbekämpfungsgebiet sehr bald als Typhusverbreiter erkannt werden. Von den typhusbazillen-ausscheidenden Menschen aber kennen wir im Bekämpfungsgebiet die allermeisten, es bleiben also als wahrscheinlichste Ursache für die grosse Mehrzahl der unaufgeklärten Typhusfälle nur die Bazillen-

träger, oder wie wir sie allgemeiner genannt haben, die Typhuswirte übrig. Der Beweis für diese Behauptung wurde ebenfalls durch die organisierte Typhusbekämpfung im Südwesten Deutschlands erbracht.

Ein kleiner Ort des Regierungsbezirks Trier wurde alljährlich von Typhus heimgesucht und ebensowenig wie bei anderen Endemien wollte es hier gelingen, den Ursprung der meisten Erkrankungen aufzudecken und dadurch zu einer wirksamen Bekämpfung zu gelangen. Schliesslich wurden auf behördliche Anregung sämtliche Bewohner des Ortes bakteriologisch untersucht, wobei fünf Typhuswirte aufgefunden wurden. Bei nachträglichem Studium sämtlicher früher bekannt gewordener Erkrankungen ergab sich nun die bemerkenswerte Tatsache, dass alle an Typhus erkrankte Personen in mehr oder minder engem Verkehr mit diesen bis dahin unbekannten Bazillenträgern gestanden hatten. Die Gefährlichkeit der Typhusbazillenträger kann also gar nicht gross genug eingeschätzt werden. Es wäre aber falsch, wenn man sich durch die Erkenntnis dieser Tatsache zu einer Bazillenträgerfurcht, zu einer Aechtung dieser Personen verleiten liesse; es ist das grosse Verdienst meines leider zu früh verstorbenen Lehrers Forster, durch wissenschaftliche und praktische Beobachtungen bewiesen zu haben, dass diese Bazillenträger für ihre Umgebung nur gefährlich werden, solange sie unsauber sind und unter unhygienischen Verhältnissen leben. Beseitigung dieser hygienischen Umstände, Erziehung zur einfachsten Sauberkeit, wie Waschen der Hände nach jeder Entleerung und von jeder Beschäftigung mit Nahrungsmitteln genügt, von wenigen unglücklichen Zufällen abgesehen, immer, die Umgebung der Bazillenträger vor Ansteckung zu bewahren. Da wir aber nur einen kleinen Bruchteil der vorhanden Bazillenträger kennen und da es auch in Jahrzehnten kaum gelingen wird, die grosse Masse zu der uns schon zur Gewohnheit gewordenen erforderlichen Sauberkeit zu erziehen, müssen wir noch auf andere Mittel sinnen, wie wir die erwiesene Gefährlichkeit der Typhusbazillenträger einschränken oder gar beseitigen können. Die Heilung der Bazillenträger durch Medikamente hat bis jetzt trotz der vielen in dieser Richtung unternommenen Versuche versagt, auch physikalisch-diätetische Massnahmen haben bisher nicht zum Ziele geführt. Die operative Behandlung hat verschiedentlich Erfolg gehabt, muss aber auf die allerdings nicht allzu seltenen Fälle beschränkt bleiben, wo sich auf dem Boden des Bazillenträgertums ein chronisches Gallenblasenleiden oder gar ein maligner Tumor der Gallenblase entwickelt hat.

Solange es unmöglich ist, die Bazillenträger therapeutisch von ihren Typhusbazillen zu befreien und auch wenn dies einmal gelungen sein sollte, muss man bestrebt sein, die Entstehung dieses Zustandes zu verhindern. Leider fehlen uns zur Lösung dieses so wichtigen

Problems bisher noch die nötigen Vorkenntnisse. Wir wissen nicht, warum von 100 Typhuskranken in der Regel 95 vollkommen genesen, aber 5 zu Bazillenträgern werden, und warum bei vielen gesunden Menschen die Aufnahme von Typhusbazillen zum *Typhus abdominalis*, bei einigen zu gar keiner Gesundheitsstörung, bei wenigen aber zum Bazillenträgertum führt.

Es erscheint auffallend, dass diese theoretisch und praktisch gleichwichtige Frage klinisch und experimentell bisher so wenig bearbeitet worden ist. Einige orientirende Vorversuche, die leider aus äusseren Gründen abgebrochen werden mussten, scheinen dafür zu sprechen, dass das Bestehen einer Immunität gegen Typhus, das dauernde, erscheinungslose Fortwuchern des Typhusbazillus im Organismus begünstigt; künstlich gegen Typhus immunisierte Kaninchen blieben nach einer einmaligen intravenösen Injektion von Typhusbazillen Bazillenträger, während bei den nicht vorbehandelten Controlltieren die Typhusbazillen bald wieder verschwanden. Diese Versuche sind deswegen nicht ganz einfach, weil die Anwesenheit von Typhusbazillen beim Kaninchen nicht durch eine Stuhluntersuchung, sondern durch Kultur der mittels Punktion der Gallenblase gewonnenen Galle zu prüfen ist, wenn man zuverlässige Resultate erzielen will. Bei diesen Bazillenträgerkaninchen hatte also die vorhergehende Impfung mit toten Typhusbazillen dazu geführt, dass die Tiere gegen die folgende Einführung von lebenden Bazillen so unempfindlich wurden, dass die Abwehrkräfte des Organismus nicht angeregt wurden und so die Typhusbazillen ungestört weiter wuchern konnten. Es ist nicht unwahrscheinlich, dass eine derartige "immunitas indolens," wie ich es genannt habe, auch für den Menschen beim Entstehen des Bazillenträgertums eine Rolle spielt, man müsste dann annehmen, dass die Bazillenträger zuerst eine zur unvollkommenen Immunisierung führende erste Infektion und dann eine zum Bazillenträgertum überleitende zweite Infektion mit Typhusbazillen durchgemacht haben. Für diese zunächst paradox klingende Annahme spricht u. a. auch die sonst kaum erklärliche, auffallende Tatsache, dass ich 31 Familien feststellen konnte, in denen 2 oder sogar mehr Mitglieder kürzere oder längere Zeit Typhus-Bazillenträger waren, während sonst im Bekämpfungsgebiet erst auf 10,000 Einwohner 2.3 Bazillenträger kommen. Mitglieder ein- und derselben Familie kommen eben häufiger als andere Personengruppen in die Lage, gleichzeitig mit Typhusbazillen infiziert und später re-infizirt zu werden. Sollte es sich durch weitere Untersuchungen herausstellen, dass eine Re-Infektion mit Typhusbazillen bei bestehender *Immunitas indolens* eine Ursache des Bazillenträgertums ist, so wären damit Fingerzeige für eine Therapie und Prophylaxe dieses Zustandes gegeben. Therapeutisch wäre zu versuchen die bei Typhuswirten besteheude *Immunitas indolens* dadurch in eine

Immunitas militans umzuwandelu, dass man den Typhuswirt mit einem möglichst reizlosen Typhusimpfstoff höher immunisiert, therapeutisch müsste während der Krankheit die Wiederaufnahme der einmal ausgeschiedenen Typhusbazillen durch peinlichste Sauberkeit, besonders der Hände sicher vermieden werden und gegen Typhus immun gewordene Personen, müssten beim Umgang mit Typhuskranken dieselbe Sorgfalt walten lassen, wie andere Personen, die noch eine Erkrankung an *Typhus abdominalis* zu fürchten haben.

Vorläufig, solange wir das Typhusbazillenträgertum weder heilen, noch sicher verhüten können, besteht bei Typhusepidemien und Endemien, in welchen eine Aufsuchung und hygienische Belehrung aller etwa vorhandenen Bazillenträger aus äusseren Gründen nicht in Frage kommt, die einzige Möglichkeit, den Typhus nachhaltig zu bekämpfen meiner Ansicht nach darin, dass die gefährdete Umgebung aktiv gegen Typhus immunisiert wird. Im militärischen Leben hat sich die Schutzimpfung gegen Typhus bereits glänzend bewährt, sie ist gerade hier in Amerika schon mustergültig durchgeführt, bei der Zivilbevölkerung stösst aber ihre Anwendung immer noch auf grosse Schwierigkeit, wegen ihrer Nebenwirkungen. Ich habe diese dadurch zu vermeiden gesucht, dass ich mittels Kultur auf eiweissarmen Nährboden und nachfolgender Reinigung durch Differentialdialyse einen Impfstoff herstellte, der neben dem spezifischen Typhuseiweiss kaum noch anderes Eiweiss enthält. Dieser neue Impfstoff, über den ich in einem anderen Vortrag eingehend berichte, verursacht tatsächlich keine Allgemeinreaktion und nur geringe Lokalreaktion, dabei erzeugt er eine ebenso starke Immunkörperbildung wie die anderen Impfstoffe. Die wichtigste Probe, die praktische Verwendung steht allerdings noch aus.

Durch meine Darlegungen hoffe ich gezeigt zu haben, dass sowohl die Entstehung als auch die Verhütung einer so bekannten Krankheit wie *Typhus abdominalis* noch eine Fülle ungelöster Probleme in sich birgt, deren Lösung der gemeinsamen Forschungsarbeit der Bakteriologen und Hygieniker aller Länder würdig ist.

EIN NEUES, EIWEISSARMES TYPHUSVACCIN.

Stabsarzt Dr. W. Fornet, Berlin.

Es mag gewagt erscheinen, die grosse Zahl der bereits vorhandenen Typhusimpfstoffe noch weiter vermehren zu wollen. Bei näherem Studium der bisher vorliegenden Berichte über Typhusschutzimpfungen wird man aber doch zu der Ueberzeugung gedrängt, dass das Ideal eines wirksamen und von Nebenwirkungen freien Typhusvaccins noch nicht erreicht ist. Die Schutzimpfung nach der Methode von Besredka mit lebenden, sensibilisierten Typhusbazillen

erfüllt zwar nach dem Bericht von Alcock die Forderung einer grossen Wirksamkeit bei geringsten Nebenwirkungen, kann aber für Massenimpfungen, um die es sich bei Typhus so häufig handelt, leider nicht in Betracht kommen, da es zu gewagt ist, in so grossem Umfange und in so schwer zu kontrollierender Weise lebende Typhusbazillen aus der Hand zu geben. Für unsere Zwecke sind nur aus abgetöteten Typhusbazillen bereitete Impfstoffe zu verwenden. Auch in der Anwendungsweise des Impfstoffs legt uns die Massenimpfung Beschränkung auf, es kommt wohl nur die subcutane, oder höchstens noch die intravenöse Einspritzung in Frage, die von Courmont und Rochaix empfohlene, anscheinend wirksame und unschädliche Art der Schutzimpfung mittels Einlauf ist für uns zu umständlich.

Die meisten jetzt gebräuchlichen Impfstoffe werden aus Agarkulturen gewonnen, weil sie bei gleicher Wirksamkeit weniger Nebenerscheinungen hervorrufen als solche aus Bouillonkulturen bereitete. Dass sie aber trotzdem noch eine ziemlich heftige örtliche Reizung und oft nicht unbedenkliche Allgemeinerscheinungen, wie Mattigkeit, Kopfschmerzen und Fieber erzeugen ist allgemein bekannt und dürfte der Grund dafür sein, dass die sonst so segensreiche Typhusschutzimpfung noch nicht mehr verbreitet und praktisch auf die Anwendung bei kriegführenden Truppen beschränkt geblieben ist. Eine Ausnahme hiervon macht nur die amerikanische Armee, bei welcher die Typhusschutzimpfung jetzt obligatorisch ist. Der hier angewendete Russel'sche Impfstoff scheint in der Tat sehr gut zu sein, da er ebenso wirksam ist wie alle anderen und in den allermeisten Fällen (62 Prozent) bei sehr geringen allgemeinen Symptomen kein Fieber hervorruft.

Die Hoffnung, diese an sich unwesentlichen, aber die allgemeine Einführung der Typhusschutzimpfung besonders auch bei der Zivilbevölkerung hinderlichen Nebenwirkungen noch weiter auszuschalten und der Wunsch die vorher genannten Vorzüge eines auf flüssigem Nährboden gewachsenen Typhusimpfstoffs auszunutzen, veranlasste mich, einen neuen Impfstoff in folgender Weise herzustellen:

Destilliertem Wasser wird 0.8 Prozent NaCl; 0.01 Prozent $CaCl_2$; 0.075 Prozent KCl; 0.01 Prozent $NaHCO_3$ und ausserdem 0.5 Prozent Pepton; kurz Aufkochen, filtrieren, sterilisieren. In dieser Flüssigkeit werden Typhusbazillen 24 Stunden bei 37° zugesetzt. Ich habe dazu bisher einen mir gütigst von Herrn Besredka zur Verfügung gestellten Stamm "Okhubo" benutzt, doch scheint die Art des benutzten Stammes nicht von so grosser Bedeutung zu sein. Die Abtötung der Kultur erfolgt durch einstündiges Erhitzen im Wasserbad bei 55°, wobei die Temperatur in der Kulturflüssigkeit selbst gemessen wird. Nach weiterem Zusatz von 10 Prozent einer 5prozentigen Carbolsäurelösung in physiologischer Kochsalzlösung

wird die abgetötete Kultur in Schleicher-Schüll'schen Diffusionshülsen gegen eine Flüssigkeit dialysiert, die sich von der ursprünglichen Kulturflüssigkeit nur dadurch unterscheidet, dass sie kein Pepton enthält. Die im Eisschrank vorsichgehende Dialyse wird solange fortgesetzt, bis in die Aussenflüssigkeit keine mit der Biuretreaktion nachweisbaren stickstoffhaltigen Körper mehr übertreten, was nach etwa 4 Tagen der Fall ist. Vor der Benutzung wird der so hergestellte Impfstoff auf seine Sterilität geprüft und eine Stunde lang im Wärmeschrank bei 55° gehalten. Er enthält, vor der Abtötung geprüft, etwa 50 Millionen lebende Typhusbazillen im Kubikcentimeter.

Dieser neue Impfstoff wurde nun mit dem von Pfeiffer-Kolle, Wright, Vincent und Russel verglichen und zunächst sein Antigengehalt im Komplementbindungsversuch festgestellt, nachdem sämtliche Impfstoffe vorher durch entsprechende Verdünnung auf möglichst gleichen Gehalt an Bazillen gebracht waren. Hierbei bewirkte 1 ccm der Impfstoffe Wright, Vincent und Russel keine Komplementbindung, der neue Impfstoff starke und der von Pfeiffer-Kolle fast vollkommene Bindung; 0.2 ccm Impfstoff rief nur bei Pfeiffer-Kolle deutliche Bindung hervor, während bei allen anderen Vaccins vollkommene Hämolyse eintrat; 0.8 und 0.4 ccm der verschiedenen Impfstoffe veranlassten entsprechende Abstufungen in der Complementbindung und Hämolyse, ein Umstand, der ebensowie der gleichsinnige Ausfall dieses mehrfach wiederholten Versuchs für die Zuverlässigkeit dieser Prüfungsmethode spricht. Voraussetzung ist allerdings, dass sowohl Typhus- wie hämolytisches Serum bis auf etwa ein Zehntel ihrer Titergrenze verdünnt werden. Intracutan nach der Methode von Römer auf Meerschweinchen verimpft riefen 0.2 des unverdünnten neuen Impfstoffs, ebensowenig wie der Wright'sche Impfstoff irgendwelche Erscheinungen hervor, während die übrigen drei auf festen Nährböden gewachsenen Vaccins Rötung, Infiltration und teilweise auch Nekrose erzeugten.

Am Menschen konnten bisher nur geringe Erfahrungen gesammelt werden. Bei den wenigen bis jetzt mit dem neuen Impfstoff geimpften Personen trat einige Stunden nach der Impfung nur minimalste Rötung, Schwellung und Druckempfindlichkeit in der nächsten Umgebung der Impfstelle auf, während irgendwelche Störungen des Allgemeinbefindens, wie Mattigkeit, Kopfschmerzen oder Fieber nicht beobachtet wurden. Acht Tage nach der einmaligen Impfung war der Agglutinationstiter des Blutserums von 0 auf 1:50, vereinzelt sogar bis 1:200 gestiegen. Diese klinischen Untersuchungen werden von den Stabsärzten Brückner und Salecker noch weiter fortgesetzt werden. Vorläufig möchte ich empfehlen, am ersten Tage 0.5 ccm, am folgenden Tage 1.5 ccm und am dritten Tage 1.5 ccm in die Gegend der Unterschlüsselbeingruben subcutan zu injizieren.

Im Vergleich zu dem Wright'schen enthält der neue Impfstoff nach den Untersuchungen von Herrn Stabsapotheker Dr. Storp ungefähr die Hälfte Gesamt- und Albumosenstickstoff, aber nur etwa ein Viertel Pepton- und Fleischbasenstickstoff; während bei Wright der Pepton- und Fleischbasenstickstoff in der Nährflüssigkeit durch die Kultur zunimmt, wird er bei dem neuen Impfstoff durch die Dialyse auf 0.07 Prozent herabgedrückt.

Nach früheren Versuchen ist anzunehmen, dass das Fehlen von unangenehmen Nebenerscheinungen nach Injektion dieses neuen Impfstoffs auf seinem geringen Gehalt an diffusiblen Eiweisskörpern beruht und dass seine im Vergleich zu anderen Typhusvaccins trotz der Eiweissarmut ungeschwächte spezifische Wirksamkeit dem schonenden Verfahren der geschilderten Differential-Dialyse zuzuschreiben ist.

In ganz ähnlicher Weise lassen sich spezifisch wirksame, aber von Nebenwirkungen freie Tuberkuline und andere Vaccins herstellen

DISCUSSION.

Dr. Ashford: Vaccines and sera were first accredited by Col. Hoff, of the Medical Corps of the Army in Porto Rico, when he vaccinated 800,000 of a population of 950,000, thus putting an effectual stop to a decennial death rate of 3,500 from smallpox. In July of this year typhoid, in epidemic form, broke out in a small town of 3,000 of the island. For some time the eyes of the Porto Rican people have been turned to the favorable results of antityphoid vaccine in their native regiment. So accredited has this vaccine become that on the outbreak of typhoid in this town the mayor, a layman, called for a general vaccination of the people in this town. This resulted in a general vaccination of the people and an abrupt termination of the epidemic. This not only demonstrates the intelligent response of the Porto Rican people to modern preventive medicine but throws some serious doubt upon the bogey of the so-called "negative phase," as at the time 30 patients were in hospital from the disease and probably not less than 60 in their own homes.

Dr. Federico Torralbas, Habana, Cuba: Although I am not a member of the Cuban Army, I take pleasure in giving you some details, in connection with Maj. Russell's paper, relating to our experience on antityphoid vaccines in the army, given to me by Capt. Ferrer, who, being unable to express himself properly in English, has asked me to do it for him. As soon as our Government knew of the results obtained in the United States Army, a delegate was appointed to study the vaccine and the methods to prepare it. We make it now at our natioanl research laboratory under the direction of Dr. Mario G. Lebredo. Capt. Ferrer was in charge of the immunization of the troops, which has not been completed on account of difficulties of transportation to the several posts throughout the island. In our

army the vaccination is not compulsory, but we have not had a single refusal, such is the good disposition of our people to accept cheerfully all prophylactic methods. Our experiences as to the general and local reactions are equal to those presented by Maj. Russell.

I give you a method which we think is entirely new—that is the immunization through the digestive tract. To that end we have made the vaccine in the form of compressed tablets containing about 50,000,000 bacteria each. This work has been performed by Drs. Lebredo and Recio, of Habana, with the purpose of facilitating immunity among children. The results in the first 12 cases are as follows:

No.	Age (in years).	Weight (in pounds)	Date.	Dose (in cubic centimeters).	Date.	Dose (in cubic centimeters).	Date.	Dose (in cubic centimeters).	Date.	Agglutination.	Reaction in 24 hours (°C.).
1....	11	48	May 23	0.2	June 3	0.5	June 18	1.5	June 28	1 x 50	36.6–38
2....	11	70	...do....	.25	...do....	.5	...do....	1	...do....	1 x 100	36.4–36.9
3....	5	35	...do....	.13	...do....	.4	...do....	1	...do....	1 x 100	36 –36.4
4....	11	43	...do....	.2	...do....	.5	...do....	1	...do....	1 x 100	36 –37
5....	11	45	...do....	.3	June 4	.6	...do....	1	June 30	1 x 150	36.4–36.6
6....	6	43	...do....	.3	...do....	.6	...do....	1	...do....	1 x 150	36.2–36.6
7....	11	51	May 27	.4	...do....	.8	...do....	1	...do....	1 x 200	36.5–36.8
8....	4	41	May 28	.4	...do....	.8	...do....	1	...do....	1 x 200	36.4–36.7
9....	7	41	...do....	.4	...do....	.8	...do....	1	...do....	1 x 150	36.6–36.6
10....	3	25	May 29	.2	...do....	.5	...do....	.5	...do....	1 x 50	36.4–36.7
11....	1	18	...do....	.1	...do....	.2	...do....	.2	...do....	1 x 50	36.6–36.6
12....	10	54	...do....	.3	...do....	.6	...do....	1	...do....	1 x 100	36.4–36.7

MAJ. RUSSELL: We do not believe that the use of living vaccine is a practical question at the present time. We could not make its use compulsory.

It is possible in the future that our vaccine may be modified, as has been indicated by Fornet and Nichols, but the time has not yet arrived to make any change.

DR. W. FORNET: There exists a great number of typhoid prophylactics already and some of them are very good, but none of them comes up to the ideal of immunizing perfectly without hurting at all. It seems as if we had somewhat neglected hitherto the chemical side of the problem by introducing into the human body additional proteins, the presence of which is unnecessary for the immunization and is able to disturb for a short time the good health of the vaccinated person. I have tried to do without these accidental proteins by cultivating the typhoid bacillus in a protein-free salt solution, to which only one-half per cent of peptone is added. Some of this peptone is used by the typhoid bacilli to build up the higher organized specific typhoid protein; the rest of the peptone I tried to remove again by dialyzing the culture against the same salt solution without peptone. The result of the various processes is an almost perfectly clear, colorless, sterile fluid, as contained in these two bottles. One cubic centimeter, injected hypodermically, causes a very slight reddening, swelling, and itching of the neighboring skin, but no general

symptoms at all, no uneasiness, no headache, no fever. Judging from the few cases in which I have tried this new prophylactic, it immunizes well; one injection raises the agglutination power of the blood serum from naught to 100 or 200, which is not the case with many of the other irritating prophylactics. This good immunizing effect is due to the mildness of the local irritation; there is no gathering of leucocytes, and therefore no immediate destruction of the typhoid prophylactic by them. All the prophylactic injected is being used for the raising of immune bodies. The harmlessness of the new typhoid prophylactic allows the injection to be repeated, if necessary, on three days following, a method of immunizing we have found as powerful as convenient. I shall be glad to provide others with this new typhoid prophylactic. Should their results prove only nearly as favorable as our own, we shall, I trust, soon be able to make antityphoid vaccination compulsory both for military and civilian population, and thereby get rid of typhoid fever altogether.

The campaign against typhoid fever, started in 1904 in the southwest of Germany, has met with a remarkable success. It has taught us that the importance of bacilli carriers, or typhoid hosts as we prefer to call them, can hardly be exaggerated. Where typhoid fever is endemic three-quarters at least of all the cases are caused by typhoid hosts. It is a well-known fact that these typhoid hosts infect healthy persons either by handshaking and the common use of various objects, or indirectly by polluting water, milk, and other foodstuff. But it is not yet generally known that simple but thorough cleanliness make these typhoid hosts harmless. We can not hope to teach everybody cleanliness. We must therefore try to get rid of the typhoid hosts. In spite of all our endeavors we have not yet learned to cure them, but perhaps there is a possibility of preventing this undesirable state of health from the beginning.

Several facts have led us to the conclusion that persons become typhoid hosts by two circumstances: Imperfect immunity and by reinfection with the typhoid bacillus. If we were to protect typhoid convalescents, inoculated persons, nurses, and other partly immune persons against that reinfection by teaching them hygienic cleanliness, we might be able to do away with typhoid hosts, and typhoid fever would disappear altogether.

But as long as not all the typhoid hosts can be detected and made harmless by hygienic teaching, as long as the coming up of fresh typhoid hosts can not be prevented, as long as the typhoid hosts can not be freed from their typhoid germs, so long we must try to protect the healthy population against typhoid fever by inoculation. This vaccination ought to be made compulsory for the whole population, as it is already for the United States Army. But we can not introduce compulsory inoculation against typhoid fever until we have learned to vaccinate without hurting at all.

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THURSDAY AFTERNOON, SEPTEMBER 26, 1912.

PREVENTION OF THE SPREAD OF INFECTIOUS DISEASES ON SHIPBOARD.

Medical Inspector E. R. Stitt, United States Navy.

The problem of dealing with infectious diseases on shipboard falls naturally under the following two heads:

1. Measures to prevent the introduction of such diseases, to limit channels for the spread of the infection, and, in particular, the methods of procedure to detect the first case of an infectious disease developing on board ship.

2. The handling of such cases when they are discovered.

As regards the first consideration, the medical officer should at all times keep himself informed as to the prevalence of infectious diseases in the ports visited by his ship. Such information is often more satisfactorily obtained through unofficial sources, where the same necessity for conservatism does not exist as would be the case with official reports. It must be the experience of everyone that information of the presence of a serious epidemic may first be obtained from observant laymen attached to his consulate who may have noted an unusual prevalence, peculiarity, or fatality of some morbid condition not usually so characterized. How often cholera is first reported as ptomaine poisoning, yellow fever as dengue, or varioloid as chicken pox.

The instinctive conservatism of the medical man makes even those who are not occupying official positions hesitate to express any view as to the existence of a certain disease unless the evidence is fairly convincing, and for an official the demands of commerce require that clinical, epidemiological, and, where possible, laboratory proof be obtained before an admission of the presence of such a disease can be elicited by the inquiring medical officer.

Furthermore, many diseases which can seriously disturb the routine of a warship are not considered of sufficient importance in many municipalities as to be notifiable. This is true of measles, mumps, chicken pox, and rotheln, cases of which may not only not be matters of official record but may become such matters of course as not to make any impression upon the medical or lay mind and about which definite information is unobtainable.

With a knowledge of the particular disease to which the crew may have been exposed, suspicion may be entertained as to the development of such particular disease and the methods of physical or laboratory examination of the crew as a whole be directed accordingly.

Of prime importance is it for the medical officer to cultivate rapid methods of determining any deviation from the normal of the body temperature, changes in the pulse rate, abnormal congestions or deposits about the throat, and in particular the inspection of the face and neck for skin eruptions.

Such examinations should be entirely objective, and it should be possible to make such examinations at a rate of from 15 to 25 men per minute. It is well, however, to have the word passed for all men who do not feel well to drop out of line and report for a more careful examination than the rapid objective one of the crew in line.

About 12 years ago I was attached to a ship where we put to sea for a cruise to the West Indies two days after receiving on board a draft of about 300 naval apprentices, and by reason of their having been exposed to measles just prior to coming aboard, and furthermore from the fact that cases of mumps and scarlet fever in men of the regular crew had only recently been sent to hospital, it was necessary to take steps to detect the first appearance of any of these diseases—measles, mumps, and scarlet fever. The method of examination as carried out was to have the men drawn up in line facing the light; the right hand was then passed down the neck opening of the shirt with the dorsal surface touching the skin of the chest as far down as the lower part of the sternum, with the left hand the pulse was estimated, and a quick glance for any eruption about face or base of neck made; the man was then directed to open his mouth wide and say "Ah."

I do not think I exaggerate when I state that this cursory examination would in all probability enable one with experience in its carrying out to detect at an early stage any important infectious disease, with the possible exception of cholera or bacillary dysentery. The expedient of having those who did not feel well drop out of line accomplished the purpose which would have been derived from a questioning as to subjective symptoms.

As is well known to quarantine officials, the thermometer is invaluable in detecting the onset of the vast majority of contagious diseases. It is my belief that with a little experience anyone can train himself to recognize an elevation of temperature approximating 1° F. with the back of the hand applied as above described. Of course we know that in a patient with the onset of a chill we have a contraction of the superficial vessels, and that such a person would not give the sensation of increased temperature. The error would be checked by the general appearance of the man as a sick man, in case he had not fallen out of line with those not feeling well.

It has not been my experience that profuse perspiration made much difference, provided the chest was well protected by the shirt and the hand pushed down well below the middle of the sternum.

Doty's experiments (New York Medical Record, Nov. 1, 1902) showed that the temperature in health almost never exceeded 99.5° F. and that temperatures approximating 99° F. were only found in the afternoon. It would therefore seem reasonable to consider that in a morning examination the highest temperature in a well person would not exceed 98.5° F. My experience is that a temperature of 100° F. or above is almost of certainty to be detected.

The taking of the pulse rate with the left hand serves as a check on the impression of increased temperature noted with the right hand. The noting of four or five pulse beats is sufficient to give one information as to increased rapidity. Naturally very little importance could be attached to the approximate pulse rate alone, especially under the conditions of the examination, but the value attributed to it is simply one of confirmation.

As regards the cursory inspection of the face and base of neck well down to the clavicular region, it would suggest itself that the inspection of such a limited skin surface would not be applicable to chicken pox, as would be the case with smallpox, measles, rotheln, and scarlet fever. While of course in chicken pox the predilection of the eruption for the trunk is rather characteristic, yet it is exceptional that there are not a few discrete vesicles on the face.

It is rather interesting that among the Filipinos the face in chicken pox is so extensively and so early involved as to make one suspicious of smallpox. The shirt of a sailor is cut sufficiently low to give a view of the base of the neck and even of the subclavicular region—the favorite sites of the early appearance of the scarlet-fever rash.

The expedient of having the person inspected open the mouth wide and give utterance to the sound "Ah" will almost surely bring out mumps in its incipiency, provided there is not some other cause which would prevent the wide opening of the mouth. It is surprising in what a large percentage of persons an adequate inspection of the pharynx and tonsillar regions can be obtained without the use of some form of tongue depressor.

This inspection of the throat would act as a control on those diphtheria cases where changes in temperature and pulse might not be appreciably altered from the normal. Koplik's spots are well shown, and in the majority of cases streptococcic scarlatinal and Vincent's anginas.

It must be carried in mind that this examination is only a preliminary to a thorough one to be subsequently made of any person whose condition may excite suspicion—it is an emergency method of selecting those in whose cases the confirmatory clinical thermometer is to be used. This method is applicable for the detection of those tropical diseases in which extension is to be feared with the exception of cholera and bacillary dysentery. Such cases, however, are ones

which would respond to the call for the dropping out of line of those feeling sick.

The limiting of the spread of an infectious disease from a case prior to its detection is best brought about by rigid adherence to the accepted rules of personal hygiene, of which the most important are avoidance of common use of articles of necessity or luxury—the drinking cup and toilet necessaries as instances of the first; the pipe, cigarette, and bottle of ginger ale of the second. Of course the bubbling fountain when properly used does away with the dangers from the common drinking cup, and elementary instruction as to the possibilities of infection from a pipe or cigarette which has been in the mouth of another person should prevent the latter.

The importance of washing the hands after defecation is well recognized as a measure to prevent the spread of such diseases as bacillary dysentery and cholera, not to mention this source of danger from typhoid carriers.

Owing to the limited space on board ship, the carrying out of this paramount hygienic measure is of great practical difficulty. By the use of a series of rubber tubes proceeding from tanks suspended in the ships' heads, the end of each tube being plugged and several small perforations being made just above the plug and the tube controlled with a Hoffman type pinchcock, there can be provided a means for supplying each man with a small but sufficient amount of water to wash his hands. Liquid soap and the paper towel now so generally in use would complete the provisions for washing the hands.

It now remains to consider the second problem of the question under consideration, viz, how to handle the case or cases of the infectious disease or diseases which have been found to be present. Of course if opportunity be available it is best to transfer cases to shore hospitals, a solution of the problem which is, however, only occasionally at hand.

In connection with the isolation of diseases having a marked degree of transmissibility, that is, for those diseases for which the designation "contagious" is especially applicable, there has probably been too much attention paid to infection by air and fomites and too little to that brought about by contact with sick or healthy carriers.

In civil hospitals for infectious diseases there are three well-recognized methods for caring for the highly infectious diseases: (1) The cubicle system in which glass partitions separate single rooms opening into a common corridor and administered as a single ward; (2) the barrier system, where recourse is had to some method of outlining the patient's bed with a cord, wet sheet, or even an encompassing white floor line; and (3) the bed isolation method where dependence for the isolation of the patient rests solely upon the observance of rigid disinfection after caring for the patient.

Crookshank [1] states that in the method of bed isolation each patient is isolated in his or her bed without partition or barrier, and he shows by statistics that with the observance of medical asepsis cross infections of the common contagious diseases are no more apt to occur than do transfers of pus infections under surgical asepsis. In his method each patient has a complete outfit of articles necessary for his nursing, which are frequently sterilized. The nurse carefully disinfects the hands and puts on a clean gown before passing from one infection to another.

More recently Rundle and Burton [2] have published statistics of the treatment by the method of bed isolation of 473 cases, including such diseases as scarlet fever, diphtheria, measles, rötheln, varicella, etc., with only two cases of cross infection, these having in each case been from scarlet fever.

Although not strictly following the bed-isolation method, but rather a modified cubicle system, yet success in preventing cross infections at the Pasteur Hospital, Paris, is attributed to medical asepsis, and here even smallpox is treated with a minimum of cross infections from such source. Of 1,994 cases of infectious diseases treated during a period of a little more than two years, there were 524 cases of smallpox. While many would consider it feasible to treat ordinary infections by the method of bedside isolation, yet we would hesitate in connection with smallpox. As a matter of fact, certain authorities have gone so far as to recommend the abandoning of isolation for smallpox, trusting solely to vaccination.

While Milne (Measles: Its Treatment and Prevention, Lancet, Apr. 22, 1911) attaches great importance to the local treatment of the individual patient's secretions, and although Crookshank rather favors a certain degree of spraying of throat and nasal cavities with oil sprays, yet this is not considered at all necessary by others.

The question of transmission of infections otherwise than by contact transference seems to rest solely with Flügge's droplet method of infection. The experiments of Winslow [3] with mouth streptococci would indicate that danger from such droplets would be slight. In these experiments plates placed only 15 centimeters in front of the mouth of a man coughing for three minutes showed only small numbers, and air taken at distances of 35 centimeters to 2.4 meters in front of persons speaking vigorously failed to show such mouth streptococci.

Strong's experiments [4] with pneumonic plague lead him to state that owing to the enormous numbers of plague bacilli the opportunities for infection by the droplet method must be very great in pneumonic-plague wards.

It would therefore seem that pneumonic plague would be a disease which could not be considered as one to be treated along the lines of bed isolation.

When we now come to consider the availability of some system of bed isolation, or rather medical asepsis for the handling of such infections on board ship, we find that Beyer in 1901–2 treated measles on board the U. S. S. *Prairie* alongside those sick with ordinary noninfectious diseases without having cross infections. In his method considerable attention was given to the local treatment of the patient, both by nasal irrigation and antiseptic applications to the entire body.[5] While the tendency on the part of those ashore seems to be in the direction of bedside isolation, some going so far as to maintain that a cubicle or barrier system gives a false confidence which militates against the observance of rigid medical asepsis—the sole agent in their opinion which prevents cross infections—yet, when we note that the cubicle system, or rather glass-partitioned isolation nests, is the system in the isolation pavilion of the Rockefeller Hospital, it would seem best that, whenever possible, ships of war should be provided with an isolation ward opening into the sick bay proper. We should then have the full protection that rigid medical asepsis would offer and what in my opinion would facilitate the carrying out of medical asepsis—the isolation nest. The idea that the barrier or cubicle tends to lessen the observance of medical asepsis seems to me to be without foundation.

For those in attendance on the infectious sick a sheet may be made to answer for the separate gown used ashore.

It would seem better to trust to the thorough scrubbing of the hands of the attendants with liquid soap and water after caring for the patient, rather than to trust to a short disinfection of the hands with bichloride. This latter might follow, but our dependence should rather be upon the thorough washing with soap and water.

As regards disinfection of all articles which may have come in contact with the infectious patient, a method I have employed even in the handling of cholera seems applicable on board ship. It is to provide two wash boilers or similar receptacles equipped with steam pipes. One container is used for disinfecting the food dishes, the other for vessels containing the excretions of the patient, in particular the bedpan, which is submerged in the boiling water—pan and contents.

The disinfection of the thermometer is in my opinion of paramount importance in dealing with infectious diseases. Of course when possible there should be a separate thermometer for each patient, but when this is not feasible dependence should be placed upon a thorough washing with soap and water and then placing in 70 per cent alcohol rather than upon the more common method of putting the thermometer in a receptacle containing a formalin solution. Unless repeatedly renewed the formalin can not be relied upon to exercise its disinfecting power.

It would seem advisable to make use of local disinfection in many of the infectious diseases. Various applications will suggest themselves, and in this connection it would appear that peroxide of hydrogen irrigations have given the best results in causing meningococci to disappear from the nasal mucosa of carriers.

While as a rule transmission of disease by fly and mosquito is of comparatively slight importance on board a warship lying at anchor some distance from the shore, yet at times flies may become very troublesome by coming aboard from garbage lighters used to take away the ship's garbage and under such circumstances the usual methods for their destruction become necessary.

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[1] Control of Scarlet Fever, Lancet, Feb. 19, 1910.

[2] Bed Isolation of Cases of Infectious Diseases, Lancet, Mar. 16, 1912.

[3] Bacterial Pollution of the Air, Journal of Infectious Diseases, Jan. 15, 1910.

[4] Journal American Medical Association, Oct. 14, 1911.

[5] Jour. of the Association of Military Surgeons, 1904.

DISCUSSION.

Surg. F. L. PLEADWELL, United States Navy, U. S. S. *North Dakota:* Dr. Stitt has pointed out the relative unimportance of air-borne transmission of infectious diseases and the very great value of the adequate care of the patient to prevent direct contagion and the treatment of utensils, etc., that may convey disease, by indirect contagion. Of the indirect means there is a common drinking device which has been eliminated in the Navy, where a special drinking terminal is in use. At my suggestion recently a naval constructor has designed a new form of voice-tube mouthpiece. This is constructed of enameled metal, is readily cleaned and disinfected, and its use would tend to further limit disease. Washing the hands at appropriate times aboard ship, instead of undue waste of water, still is a problem with the enlisted men, and toweling for drying is also a difficulty, which I have hoped might be solved by the introduction of a cheap paper towel. I believe Surg. Fiske in our service has had some experience in this direction, and I hope he can give us some information upon this subject.

Surg. CHARLES N. FISKE, United States Army: In response to Surg. Pleadwell's inquiry I will say that paper towels have been accepted and used by commissioned and warrant officers on board certain ships on which I have served during the last two years. All chief petty officers mess and usually sleep in the same compartment, so that the few who will manifest public spirit by standing their share of the expense of paper towels are overruled by the majority who have not become sufficiently enlightened. Paper towels have given me every satisfaction in the medical department

of ships and I have strongly urged their supply by the Government for sick quarters, water-closets, scullery, and wash rooms generally. Such recommendations will hardly prove effective until medical officers generally have educated officers in administration and executive authority.

L'AIR DANS LES SUBMERSIBLES PLONGÉS.

Dr. C. M. Belli, Médecin principal de la Marine Royale Italienne et Professeur agrégé d' Hygiène à l'Université de Padoue, rapporteur, et Dr. G. Olivi, Médecin capitaine de la Marine Royal Italienne.

Etant donné l'importance qu'on attache aujourd'hui aux bâteaux submersibles parmi les instruments de guerre navale, on a nouvellement poussé toutes les études, qui ont pour but d'en prolonger l'habitabilité, c'est-à-dire plus rigoureusement, la respirabilité de l'air dans les submersibles plongés. Jusqu'à présent on a eu recours:

I°. Aux substances chimiques qui développent l'oxygène et à celles qui absorbent le CO_2 produit par la respiration animale.

II°. A l'emploi, dans une mesure très réduite, de l'air comprimé existant à bord des submersibles.

Mais il y a dans les deux cas des inconvénients nombreux, tandis qu'il est très facile de donner à l'air l'oxygène perdu, il n'en est pas ainsi lorsqu'il s'agit d'absorber le CO_2; il faut alors employer des substances alcalines encombrantes par leur poids et leur volume, très souvent difficiles à manier, dangereuses même et peu pratiques à cause des réactions et des combinaisons chimiques auxquelles elles donnent lieu. En tout cas nous sommes dans l'impossibilité d'éloigner de cette façon les autres produits nuisibles à l'organisme humain qu'on a récemment signalé (antropotoxines, xénotoxines) et tous les gas qui sont développés par les accumulateurs électriques.

Dans le deuxième cas la quantité d'air comprimé qu'on peut mettre à notre disposition sans déranger les manœuvres du bâteau est trop faible et par conséquent le renouvellement d'air trop limité.

Nous entreprîmes trois séries de recherches pour établir:

I°. Les altérations que subit l'air pendant les immersions.

II°. Les avantages que pouvait nous donner l'emploi d'une substance chimique dernièrement proposée, c'est-à-dire l'oxylithe "S" (bioxide de sodium).

III°. Les avantages d'une nouvelle méthode proposée par le Dr. Olivi et moi-même d'un large renouvellement d'air répété plusieurs fois pendant les immersions; sur les détails de laquelle méthode nous sommes obligés de garder le secret militaire.

Dans la première série nous avons accompli trois immersions avec l'équipage au complet, et après six heures nous avons obtenu

au moyen de l'examen chimique: (1) Oxygène, 16.6 pour cent (minimum); (2) CO_2, 13.8 pour mille (maximum); (3) H_2S, gr. 0.00028 pour M. C.; (4) SO_2, gr. 0.010 pour M. C. Monoxide de carbone, ammoniaque, acides nitreux et nitrique, chlore: zéro.

Dans la deuxième série nous nous sommes borné à une seule immersion de six heures avec l'équipage au complet pour essayer les avantages donnés par l'oxylithe "S" en augmentant l'oxygène d'un côté et en absorbant le CO_2 de l'autre. Après quatre heures d'immersion l'examen chimique nous révélait: (1) Oxygène, 19.1 pour cent (moyenne); (2) CO_2, 18.8 pour mille (moyenne).

C'est alors que nous avons fait fonctionner quatre gazomètres à oxylithe, qui développèrent 263.56 litres d'oxygène. Après six heures d'immersion l'examen chimique nous donnait: (1) Oxygène, 18.8 pour cent (moyenne); (2) CO_2, 18.9 pour mille (moyenne). C'est-à-dire, avantage obtenu par l'oxygène développé et influence presque nulle de l'oxylithe vis-à-vis de l'acide carbonique, ce qui a été constaté aussi avec l'analyse chimique du résidu de la réaction: les quatre gazomètres avaient absorbé en totalité gr. 22.52 de CO_2, c'est-à-dire, 1/208 de la quantité totale. Il y a évidemment plusieurs raisons chimiques et mécaniques sur lesquelles il serait trop long de discuter, qui empêchent une absorption plus sensible.

La troisième série a établi avec trois immersions la supériorité de la nouvelle méthode que nous venons de proposer. On a commencé d'abord par un essai préliminaire de six heures d'immersion avec l'équipage au complet et on a renouvelé l'air une seule fois dans une mesure très réduite (M^3 2,860).

L'air examiné avant et après le renouvellement nous a donné les moyennes de CO_2, ci-dessous: Avant le renouvellement, 18.5 pour mille; après le renouvellement, 14.4 pour mille. Et c'était assez pour nous convaincre que nous étions sur le bon chemin.

La deuxième immersion de 22 heures consécutives nous a donné les résultats ci-dessous:

		Avant.	Après.
1. Renouvellement d'air—			
CO_2	pour mille..	[1] 24.0	6.9
O	pour cent..	18.4	20.1
2. Renouvellement d'air—			
CO_2	pour mille..	16.2	7.0
O	pour cent..	19.1	20.3
3. Renouvellement d'air—			
CO_2	pour mille..	25.2	14.3
O	pour cent..	19.3	20.0

	Au commencement.	A la fin.
SO_2	[2] 0.0688	0.0189
H_2S	[2] 0.0011	0.0000

[1] Moyenne. [2] Gr. pour M^3.

La troisième immersion fut prolongée jusqu'à 24 heures avec ces résultats:

	Avant.	Après.
1. Renouvellement d'air—		
CO_2 ..... pour mille..	[1] 21.5	[1] 16.0
O ..... pour cent..	[1] 19.3	[1] 19.7
2. Renouvellement d'air—		
CO_2 ..... pour mille..	[1] 32.3	[1] 22.3
O ..... pour cent..	18.7	18.9
3. Renouvellement d'air—		
CO_2 ..... pour mille..	33.3	30.9
O ..... pour cent..	18.7	18.8

	Au commencement.	A la fin.
SO_2	[2] 0.300	0.314
H_2S	[2] 0.017	0.002

[1] Moyenne. [2] Gr. pour M³.

Cette dernière immersion fut accomplie dans des conditions d'humidité (saturation) et de température (+28°, 4 C) très défavorables, ce qui accroît beaucoup la valeur des résultats obtenus. Il faut ajouter que au bout des 24 heures nous étions encore en condition de prolonger notre séjour sous l'eau par un dernier renouvellement d'air.

Malgré tous les obstacles qui, dans l'endroit d'un submersible, limitent à tout pas des recherches semblables, nous pouvons donner les conclusions suivantes:

CONCLUSIONS.

I°. L'examen direct exclut complètement la production du monoxide de carbone (CO).

On peut raisonnablement attribuer le sens très léger de céphalalgie souffert par la plupart de l'équipage pendant la dernière immersion (24 heures) à la haute proportion du CO_2 (37.2 pour mille) et on peut ainsi exclure la présence des produits toxiques signalés par certains auteurs (antropoxines et xénotoxines). Il faut considérer de très grande importance aussi pour les problèmes d'hygiène générale la haute proportion d'acide carbonique dans l'air des submersibles avec une température élevée et saturation d'humidité, car on peut ainsi confirmer la possibilité de vivre et même de travailler pendant plusieurs heures dans une atmosphère contenant une proportion de CO_2 supérieure au 37 pour mille.

II°. Le renouvellement de l'air est, sans exception, le meilleur moyen apte à prolonger les immersions des submersibles sans communication avec l'atmosphère extérieure, aussi au delà de 24 heures entretenant l'équipage en état physiologique.

III°. La nouvelle méthode proposée ne présente aucun inconvénient et rassure complètement l'habitabilité des submersibles pendant les immersions ordinaires, car elle éloigne de l'atmosphère close de ces bâteaux tous les gas qui, dans certaines proportions, seraient nuisibles à l'organisme humain.

IV°. La régénération de l'air avec des substances chimiques doit être regardée comme une extrême ressource lorsqu'il n'est plus possible de renouveler l'air et qu'il faut prolonger la vie en attendant les secours.

A HYGIENIC INTERPRETATION OF THE FOOD SUPPLIED THE UNITED STATES ARMY IN THE FIELD, AS AT PRESENT AUTHORIZED.

Brig. Gen. ALFRED A. WOODHULL, United States Army (retired).

Until very recently the food supply of the United States Army was arranged upon a sliding scale, corresponding to the duty engaging the troops. At one extreme was the emergency ration, the nature of which is shown by its name. It need not be considered at this time. At the other was the garrison ration, also supplied to formal camps, consisting of 17 regular constituents and 28 that are substitutive. To troops beyond the advance depots, the haversack ration was issued. This was for carriage upon the person; an individual supply when in actual or potential contact with the enemy, corresponding to the soldier's personal ammunition. It was the minimum quantity and variety for daily use; it included no extras, and several days' rations might easily be carried together. Midway in composition and complexity between these extremes there was also a specifically designated field ration, containing 12 regular and 12 substitutive components. In a recent discussion of the ration and its management, having special reference to conditions in the field, the writer remarked:[1]

"It is a possible question whether in time of war its cost and profusion may not interfere with its actual distribution."

Since then the field ration, as such, has been definitively abandoned, and troops beyond the advance depot are to subsist upon the haversack ration, supplemented in the discretion of the commanding general by specially authorized articles of the garrison ration, issued by the Subsistence officers when acquired by shipment or local purchase. But such additional and occasional issues establish no claim for a commutation credit against undrawn standard components. They are free grants, not to be regarded as a prerogative; and because they are gratuitous and irregular they can not be estimated, nor should they be accounted for, in a paper like this. It is true that in one sense the garrison ration is also a field ration, in that it is issued to troops hutted or under canvas whenever practicable in peace or war; and this would frequently include a moving camp, as long as it

did not leave its own advance depots in the rear. But to treat of that would be to discuss the whole military food supply, which is not presumed to be the object of this assigned subject. We have, therefore, the haversack ration only, as that on which to depend in field operations, although under favorable conditions the available supplementary components taken from the garrison ration might be important additions. But these are no more a part of the stated food supply than would be occasional extra meat and vegetables seized for convenience in an enemy's country.

The man with the haversack ration cooks his own food. For this purpose he is equipped with an aluminum cup which can be used on the fire; a block tin dish and plate, which fit together with a handle for manipulation and to lock them when assembled for carriage; and with a knife, fork, and spoon. This ration has been slightly modified recently by the omission of two one-hundredths of an ounce of black pepper, and the addition, as an alternative, of 1 pound of canned meat in lieu of three-fourths of a pound of bacon. In detail it is: Bacon, 12 ounces (340.2 grams), *or* canned meat, 16 ounces (453.6 grams); hard bread, 16 ounces (453.6 grams); coffee, roasted and ground, 1.12 ounces (31.75 grams); sugar, 2.4 ounces (68.04 grams); salt, 0.16 ounce (4.54 grams).[2]

The bacon and the canned meat are in light key-opening tins; and each of the other articles is inclosed in waterproof wrappings; hence there is little waste in handling, and the losses are those from sheer carelessness. Havard reckons the dietetic value of the regular haversack ration to be that of 218 grams of fats, 489 of carbohydrates, and 113 of potatoes. Conservatively, it contains a total fuel value of 4,200 calories. Probably it is somewhat greater. The substitutive canned meat is cooked lean beef hermetically sealed. An obvious advantage of this ration, all of which may be consumed and assimilated, is its freedom from the waste, like bone and vegetable peelings, that always belongs to food which passes through the kitchen on its way to the table.

The men to whom the haversack ration is issued are, physiologically, engaged in "hard labor." That is, they are actively occupied in the open air, presumably in the presence of the enemy, and almost certainly either marching vigorously or engaged in those strenuous operations of offense or defense which, in fact as well as in theory, make up the life of the soldier in campaign. Besides undergoing daily fatigue from incessant work, they are liable to exposure to inclement weather, are practically unsheltered by night as well as by day, and in the very nature of the case their physical activities involve the expenditure of tissue in the generation of muscular force as well as in the maintenance of animal heat. The food is required to replace the normal and the unusual waste, and to evolve

energy. In comparison with the profuse and complicated garrison ration, the field ration is not only limited in its components but at first sight it appears inadequate. But, as just stated, its theoretical value is really in excess of the physiological requirements: and, moreover, it has been demonstrated repeatedly by actual experiment that the allowance for five days will maintain, with trifling loss of weight, the health and vigor of soldiers actively engaged for at least twice that period. The haversack ration therefore may fairly be accepted as entirely sufficient for its purpose.

In view, however, of the circumstances under which it is used, namely, by individuals undergoing severe exertion and not infrequent exposure and not in permanent camps with competent company cooks and organized messes, it seems better to increase the individual issue of the roasted and ground coffee to 1.44 ounces (40.82 grams) and the sugar to 2.88 ounces (81.64 grams), respectively, or 9 and 18 pounds each per hundred rations. Coffee is a gentle stimulant practically without reaction, and is particularly acceptable to the American soldier. Its special value is the resistance it offers to fatigue and cold, increased by the volume of hot water in which it is taken. An additional hygienic quality in the field lies in the water being sterilized by the boiling it usually undergoes. A slight increase in the allowance of sugar is also commended, because it conveniently supplies an immediate although comparatively transient access of energy. It is not merely a spur: it is a real increment of force that follows the assimilation of sugar. Both of these small parts of the ration are issued as coarse powders and are liable to loss when simply wrapped in paper, notwithstanding it may be paraffined. To supply nonexpendable waterproof covers, like shotgun shells, each to contain a half ration, or one ration, of coffee or sugar would not be costly. These should preserve their contents from waste and protect against dampness.

Besides the haversack ration, or any other food supply, every soldier in the field always carries one emergency ration packed in a light, sealed, metallic case, which may be opened only by an officer's order or in extremity. It contains three 1½-ounce (42.53 grams) cakes of equal parts of pure chocolate and pure sugar, and three 4-ounce (113.40 grams) cakes of meat and wheat. These consist of 16 parts of specially prepared meat flour, 32 parts of coarse wheat powder, and 1 (1.33 grams) of salt, all by weight, homogeneously mixed. With these, separately, are three-fourths of an ounce (21.3 grams) of fine salt and 15 grains (1 gram) of black pepper. The meat and wheat may be eaten dry or may be stirred in cold water, or may be made into soup, or into a thick porridge to be eaten as such, or be sliced and fried should fat be available. This ration maintains life and energy for a single day, but is not suitable for a

prolonged diet. It is, as its name indicates, for emergency use; and every soldier starts out with one of these cases. Its physiological value is that of 102 grams (3.6 ounces) proteid, 54 (1.9 ounces) fat, and 153 (5.4 ounces) carbohydrates, and its fuel value is 1,500 calories (Langworthy). It is understood that the emergency ration may soon be altered, but that it has not yet been changed. Its merely temporary and exigent nature is iterated.

The formal and regular ration for the field, that borne in the haversack, has now been described; and as long as the command keeps in advance of the Subsistence depot nothing more is to be expected. But as a matter of fact even the most active and energetic troops can not constantly keep completely out of touch with the advance depots. An advancing army, not too greatly impeded by the enemy, will put its supply arrangements further and further forward, and from these, by pack animal and wheel, it will maintain some connection with the advancing column. And, per contra, the lines must sometimes be drawn in, or be driven in, and thus there will be at least a temporary association with the depots. Whenever this occurs, in either advance or retreat, or during those prolonged lulls in offensive operations that sometimes occur, it is within the option of the commanding general materially to add to the food supply of the active troops from the very wide range of components, normal and substitutive, that make up the regular ration, and such gratuitous additions may always be expected to be made. As said earlier, these are strictly supplemental if not superfluous, particularly when it is remembered, as is constantly to be impressed upon the soldier, that rations for 5 days will really suffice for 10, because the half ration contains rather more of the food elements than a mere subsistence diet requires. The chief obstacle to effective feeding is not insufficient food but the tendency to wastefulness. The average civilian is not instinctively a cook and the recruit requires careful instruction, although at the beginning of his service, when such knowledge is most necessary, he acquires it chiefly by hard experience.

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[1] Military Hygiene, 4th ed., p. 95.

[2] The non-military reader is advised that the last three articles occur in fractional weights because, for convenience, rations are bought and issued by the hundred and are subdivided, when necessary, for use by the individual. A hundred rations of coffee, sugar, and salt would weigh, respectively, 7 pounds, 15 pounds, and 1 pound. The metric fractions follow from necessity.

HYGIENIC INTERPRETATION OF RECENT CHANGES IN THE FIELD RATIONS AND THEIR PREPARATION.

HENRY C. FISHER, Lieutenant Colonel Medical Corps, United States Army.

An executive order, dated January 11, 1911, prescribed the present garrison ration and a haversack ration. It also provided for an emergency ration to be prepared under the direction of the War Department.

The component articles of the garrison ration, the quantities, and the substitutive equivalent articles which may be issued in place of such components are as follows:

Garrison ration.

Component articles and quantities.		Substitutive articles and quantities.	
Beef, fresh	20 ounces	Mutton, fresh	20 ounces.
		Bacon	12 ounces.
		Canned meat, when impracticable to furnish fresh meat.	16 ounces.
		Hash, corned beef, when impracticable to furnish fresh meat.	16 ounces.
		Fish, dried	14 ounces.
		Fish, pickled	18 ounces.
		Fish, canned	16 ounces.
		Turkey, dressed, drawn, on Thanksgiving Day and Christmas, when practicable.	16 ounces.
Flour	18 ounces	Soft bread	18 ounces.
		Hard bread, to be ordered issued only when the interests of the Government so require.	16 ounces.
		Corn meal	20 ounces.
Baking powder	0.08 ounce		
Beans	2.4 ounces	Rice	1.6 ounces.
		Hominy	1.6 ounces.
Potatoes	20 ounces	Potatoes, canned	15 ounces.
		Onions, in lieu of an equal quantity of potatoes, but not exceeding 20 per cent of total issue.	
		Tomatoes, canned, in lieu of an equal quantity of potatoes, but not exceeding 20 per cent of total issue.	
		Other fresh vegetables (not canned) when they can be obtained in the vicinity or transported in a wholesome condition from a distance, in lieu of an equal quantity of potatoes, but not exceeding 30 per cent of total issue.	
Prunes	1.28 ounces	Apples, dried or evaporated	1.28 ounces.
		Peaches, dried or evaporated	1.28 ounces.
		Jam, in lieu of an equal quantity of prunes, but not exceeding 50 per cent of total issue.	
Coffee, roasted and ground.	1.12 ounces	Coffee, roasted, not ground	1.12 ounces.
		Coffee, green	1.4 ounces.
		Tea, black or green	0.32 ounce.
Sugar	3.2 ounces		
Milk, evaporated, unsweetened.	0.5 ounce		
Vinegar	0.16 gill	Pickles, cucumber, in lieu of an equal quantity of vinegar, but not exceeding 50 per cent of total issue.	
Salt	0.64 ounce		
Pepper, black	0.04 ounce		
Cinnamon	0.014 ounce	Cloves	0.014 ounce.
		Ginger	0.014 ounce.
		Nutmeg	0.014 ounce.
Lard	0.64 ounce		
Butter	0.5 ounce	Oleomargarine	0.5 ounce.
Sirup	0.32 gill		
Flavoring extract, lemon	0.014 ounce	Vanilla	0.014 ounce.

The haversack ration consists of:

	Oz.
Bacon	12
Or meat canned	16
Hard bread	16
Coffee, roasted and ground	1.12
Sugar	2.4
Salt	.16

Army Regulations state:

> The garrison ration is intended for troops, whenever practicable, in time of peace; also in time of war, except for those beyond the advance depots; the haversack ration is intended for the troops beyond the advance depots, and the emergency ration for troops in active campaign for use on occasions of emergency.[3]

We note that the formerly specified field ration is omitted. It is especially provided:

> When in the exigencies of the service troops are subsisted on the haversack ration and it is found to be practicable to supplement these stores by local purchases or by shipments, the commanding general may direct, in written orders, the issue in kind, in addition to the haversack ration, of such available articles of food not in excess of the amounts allowed of corresponding articles in the garrison ration.[3]

Thus the field ration may be a very variable one, ranging from the simple haversack ration to the elaborate garrison ration.

The haversack ration with the bacon constituent is estimated to furnish 113 grams of protein, 218 grams of fat, and 489 grams of carbohydrates, with a total food value of 4,448 calories.[4]

The garrison ration, according to the components selected, will furnish from 2,500 to 5,674 calories.[4] According to Havard:

> The average garrison ration, habitually consisting of fresh beef, soft bread, beans, potatoes, and onions, dried fruit, butter, sirup, and sugar (or their nutritive equivalents), contains 99 grams of fat, 481 of carbohydrates, and 157 of proteids, with a total food value of 3,536 calories.[4]

It is considered that the haversack ration furnishes a nearly ideal ration for the purposes intended. It is compact, concentrated, having little waste material, and affords the elements of nutrition in very nearly proper proportions. It is the food with which the American soldier is familiar and has stood the practical test of being the articles selected by every experienced camper and prospector who has had to travel with limited transportation.

While the fats of the haversack ration are manifestly excessive the soldier will never ingest them all, as a very large proportion will be lost in the necessarily wasteful process of preparing food in the field. The recent order allows 16 ounces of canned meat, as roast or corned beef, as an alternative component for the 12 ounces of bacon.[1] This would contain less of the excess of fat and a desirable increased amount of protein at the same time that it affords the change necessary for proper appetite.

Experience has demonstrated that the haversack ration, despite the theoretically large number of calories, is insufficient for prolonged use to keep soldiers in health and condition. Only exceptionally would they be subsisted upon it, probably during periods of great exertion and strain. As soon as possible it would be supplemented by all the articles of the garrison ration ample to make up for previous deprivation. Then fresh meats, soft bread, and vegetables would supply the needed change of diet and additional nutriment and, with the dried and canned fruits, counteract any scorbutic tendencies.

The hard bread furnished for the haversack ration, and formerly our main dependence for field use, is excellent within its limitations, but lacks a pleasing taste, palls upon the appetite, and undoubtedly tends to gastrointestinal complaints on account of its hardness. One of the greatest advances made by our Subsistence Department is its recently perfected provision for supplying fresh bread for troops in the field. The Commissary General says:

> It is a great satisfaction to note that the development of a suitable type of continuous knockdown field oven has been made, and that for the first time since the close of the Civil War, by the means provided the troops by the Government itself, it has been possible to supply all the troops in camp with fresh bread of excellent quality. With the development of suitable ovens, we now have prescribed in the Field Service Regulations a division field-bakery column, which will enable fresh bread to be supplied to the troops in the field whenever it is possible to reach them with supplies. The type of oven thus developed—a continuous knockdown baker—with the necessary bakery equipment and the tentage, can be packed into one wagon, and thus reduce the transportation of the field-bakery column over 50 per cent of that which would be required in the case of rolling ovens, as in many of the foreign armies. When the rolling oven is thus in use, an additional wagon is necessary to carry the bakery equipment.[5]

During the Texas maneuvers, in the summer of 1911, a possible product of these ovens was thoroughly tested and gave entire satisfaction. This so-called field bread is a type of fresh bread, with a thick crust, made to withstand long transportation and keep from 10 days to 2 weeks or longer.[6] It is intended for use only when troops can not be furnished with soft bread. The Commissary General believes that it can be supplied in place of hard bread under most conditions and will materially promote the health and comfort of the troops.[7]

Field Service Regulations prescribe:

> As a rule, messing is by company units, though it may become necessary to form messes by squads or even to require individuals to do their own cooking. For this reason instructions are given all men as to the proper method of preparing the haversack and emergency rations.[8]

Due to the new and excellent type of field ranges recently adopted, cooking in camp is similar to cooking in garrison and nearly the same

wholesome well-prepared food can be supplied. The Commissary General declares of these ranges:

> They are believed to be the very best devices for field cooking which have ever been used in any army. While they are sufficient to cook for a company at war strength, it is yet possible to arrange them to make them adaptable for pack transportation, and, if subsistence by companies is done in the field, it is thought that this type is the very best that can be procured.[5]

In the field each soldier uses his individual mess kit to eat from. When the Company cook announces the meal with the time-honored shout of "Come and get it!" he is promptly on hand to receive his portion, carrying it away to eat at the most convenient place. The tendency is to take away more than can be eaten. This, with the lack of facilities in the field, leads to waste, so that the soldier can not live so well on the straight ration in the field as he can in the garrison.

When pack transportation is no longer available, the field range must be abandoned; but boilers and other utensils may be carried by the cook. Then only boiling and frying can be done unless clay ovens or dugouts are constructed.[9]

It is to be anticipated that occasionally each soldier will have to cook his own food, and Army Regulations require that "one day in each alternate month of the season of practical instruction, not exceeding three days in each year, the use of the haversack ration, with individual cooking, will be required by all troops in the field for the purpose of instruction."[2]

Each soldier carries in his haversack utensils for cooking and serving food, comprising a meat-ration can, tin cup, knife, fork, and spoon. The meat-ration can is well adapted for frying, the cup for boiling, and "almost anything that can be cooked at all can be prepared in this mess kit."[9]

The present haversack has not been altogether satisfactory, containing as it does components of the ration in a more or less untidy manner, with toilet articles and cooking utensils that necessarily become fouled, all dumped in together. It is difficult to clean and to keep clean.

The new haversack recommended by the Infantry Equipment Board is an expansible receptacle capable of holding three or four days' rations. It can be opened out flat for thorough airing, washing, and cleaning. It is to contain half-pound cartons of hard bread $7\frac{1}{4}$ by $2\frac{1}{2}$ by $2\frac{1}{2}$ inches, a bacon can, and a triple canister, each the size of the above carton. The former holds two rations of bacon, the latter three of coffee, sugar, and salt. One ration of bacon may be carried in the meat can. "To minimize fouling of the haversack by unclean ration utensils, a special removable receptacle therefor is laced to the outside of the haversack."[10]

A new flask-shaped canteen with a flat bottom and a nested cup has been provided. Water can be boiled in it, and it is an improvement upon the romantic old article which is so difficult to clean.[10]

Field Service Regulations provide that each man carry in his haversack one haversack ration and one emergency ration. "When combat is probable, or troops are liable to be separated from their field trains, each man starts with one additional haversack ration."[8]

Army Regulations state: "The emergency ration is furnished in addition to the regular ration for troops in active campaign or in the field for purposes of instruction, and will not be opened except by order of an officer or in extremity, nor used when regular rations are obtainable."[2] Various kinds have been tried but none yet definitely adopted. The Commissary Department has recently devised and approves an emergency ration which seems excellent of its kind. It weighs 8 ounces and consists of chocolate liquor, nucleo-casein, malted milk, egg albumen, powdered cane sugar, and cocoa butter. It furnishes 52 grams proteid, 72 grams fat, 110 grams carbohydrates, with a food value of 1,334 calories. The ingredients are compressed into three cakes resembling a chocolate confection and inclosed in a sealed tin can. It is pleasant to the taste and may be eaten without further preparation.

There seems to be considerable question about the desirability of an emergency ration, and the equipment board recommended that an additional haversack ration be substituted for the emergency ration now carried by each soldier in campaign.[10]

In conclusion, it is believed that the recent improvements in the field rations and the means of preparing them provide a dietary for soldiers that leaves but little room for improvement. While the haversack ration is somewhat meager the provision for supplementing it affords a sufficient but not an excessive amount of nourishment. It is a wise provision that supplies young men undergoing the necessary exertion and hardship of a soldier's life with an abundance of wholesome food, and a large experience of practical life has demonstrated that this class of men requires the ample food supply provided.

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[1] General Order 15, War Department, 1911.
[2] Paragraph 1226, U. S. A. Regulations, and G. O. 60, W. D., 1911.
[3] Paragraph 1223, U. S. A. Regulations, and G. O. 60, W. D., 1911.
[4] Havard's Military Hygiene.
[5] Report of the Commissary General, 1910.
[6] Circular No. 5, War Dept., Commissary General Office, 1911.
[7] Report of the Commissary General, 1911.
[8] Field Service Regulations, U. S. A.
[9] Manual for Army Cooks, 1910.
[10] Infantry Journal, September, 1910.

VALUE TO THE ARMY IN CHANGES IN THE RATION AND ITS PREPARATION.

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The subject of the soldier's ration, its supply and preparation, is of prime importance. Without food the human engine can not develop the power required, and if not furnished and prepared in a sanitary manner the number present for duty on the firing line, whether real or simulated, will naturally be decreased. In garrison the problem of a proper administration of the soldier's diet is comparatively simple. It is under the changed conditions of life in the field, especially under adverse and difficult methods of supply, that the problem becomes one in which keen and constant effort is required on the part of all, not only to subsist the soldier but to endeavor to avoid the malign effect of improper food.

Naturally the troops of the least experience are the greatest sufferers, and it will always be so. Individual training of the man must be, and is, the only remedy for such a condition.

We have advanced materially in the last decade in matters pertaining to the personal hygiene of the soldier. It has been but a few years since the time when, if one or more day's ration were carried by the soldier personally, it would consist in the main of bacon and hard bread, wrapped in the first bit of scrap paper upon which he could place his hands; then placed in the haversack to keep company with a pipe, a toothbrush, or the many other articles therein. The treatment of the hard bread was the same. Many stomachs survived; in fact, probably the great majority; but one case of illness from a bit of food contaminated in this way was one too many. Now, how differently we furnish the soldier with this simple and efficient ration. The bacon is inclosed in a sealed tin box, the hard bread in a sealed carton, both articles free and safe from pollution.

This change is one of the greatest steps ever made to guard the health of the individual. It is not the purpose of this article, however, to go much further than to briefly outline the various rations now supplied, their method of preparation, and to point out by comparison the advancement over former methods. Troops are always living under one of two conditions—in garrison or the field.

SUBSISTENCE IN GARRISON.

When located in permanent garrison, troops are subsisted upon the garrison ration; the general manner of messing is by company messes which are conducted under the supervision of the officer

commanding the company. The garrison ration is ample in quantity, and the equipment of the company kitchen is so complete as to present no difficulty either to the proper preparation of food or to the strict enforcement of complete and entire cleanliness in handling it from the raw state until it is placed before the soldier for consumption. The next step in the subsistence of the soldier is when he passes from garrison life into life in permanent or semipermanent camps. Facilities for caring for foodstuffs and the disposal of waste are not as convenient or elabaorate as in garrison life, but adequate methods are in use by which all the rules of health can be observed. The ration in camps of this kind remain the same as in garrison. Prior to January, 1911, the Army was subsisted, when in the field, on a ration known as the "field ration." For several years this particular ration had been added to, amplified, and improved until it had become in fact almost the same in the components and substitutive articles as the one first referred to, i. e., the garrison ration.

It being recognized that the question of supply in camps, permanent or semipermanent, was but little different from that of supplying permanent posts, but that beyond a certain point in field service the bulky field ration could not be supplied. On January 25, 1911, the field ration was abolished for reasons previously stated, also its excessive bulk and the consequent difficulty of being carried in the haversack. Its place was filled by a ration officially termed the "haversack ration." It was similar to a ration of the kind adopted in 1908, in addition to the now abandoned field ration, except that the substitution of canned meats in lieu of bacon was authorized for the reason that bacon may not, and, in fact, is not, always procurable when desired in large quantities on short-time demand, but any deficiency can always be filled by corned-beef hash or like meat products. The condiment (pepper) was eliminated from the ration also, it being unduly expensive in the form furnished. The haversack ration fulfills as nearly as possible all requirements of a simple and efficient ration. It is easly carried by the soldier, being compact and weighing less than 2½ pounds.

The haversack ration for one day is: Bacon, 12 ounces, or canned meat, 16 ounces; hard bread, 16 ounces; coffee, R. and G., 1.12 ounces; sugar, 2.4 ounces; salt, 0.16 ounce.

When troops are subsisted on the haversack ration, and it is practicable to supplement it, the commanding general may direct the issue in kind, in addition to the ration, such available articles of food, not in excess of the amounts allowed, by corresponding articles of the garrison ration.

The haversack ration is furnished and intended for troops beyond the advance depots. It is upon this ration that the bulk of work in time of war must be done. Its superior sanitary advantages over

the old manner of handling the personal ration has been touched upon early in this article.

In addition to the ration above described there is another, which constitutes the final reserve of the soldier, namely, the "emergency ration." This, in its present form, consists of a sealed tin receptacle containing three cakes (each one meal), made of sweetened chocolate, malted milk, and dessicated eggs, in the proportion of 68 per cent chocolate, 18 per cent malted milk, and 14 per cent dessicated egg. The ration is issued to the soldier upon entering active service, and it is strictly enjoined that it is not to be used except as a last resort, or when in dire necessity, or upon the order of an officer. Once used it is replaced as soon as possible. The value and need of such final reserve is apparent. The various rations which have been mentioned are the product of years of campaigning, and of many experiments, out of which has come this better order of things. The garrison ration is elastic and sufficient. The haversack ration has become a neat, sufficient, and sanitary article, where once, in its manner of handling, it was an abomination. By bringing ourselves down to the three rations named the problem of supply has been simplified. No explanation of the soldier's ration would be complete without an outline of the manner in which it is cooked in the field; hence, it is necessary to consider the subject of camp cookery.

In no other branch of the military art is there so great a difference between the professional soldier and the amateur as in the preparation of food in the field. An army properly fed (and properly fed covers the whole field of supply and hygienic preparation) is the foundation of an efficient force, no matter though they be raw troops lacking in all the elements of military training. Napoleon's often-quoted statement is ever true, that "an army marches upon its belly." It can well be said, "No stomach, no soldier."

CAMP COOKERY.

Camp cookery is of three kinds—in permanent and temporary camps and cooking at daily camps from day to day. The general principles are the same, the differences being only as to the conveniences at hand in each case.

The appetite of healthy men, taken from quarters and placed in the field, increases for the first few days. It is also in the first few days that green troops are most liable to suffer from the changed conditions of life which they are undergoing.

COMPANY KITCHEN.

Each company has its kitchen on its flank, and in line with its row of tents. The simplest kitchen consists of a trench, dug in the direction of the wind, of such width that the kettles, when placed upon it, do not project more than 1 inch beyond each side. The depth of the

trench should be about 12 inches at the end from which the wind is blowing and should continue at that depth for 4 feet, decreasing then gradually in depth for about 3 feet, until only 3 inches in depth, when a space is left equal to the length of the trench to serve as a flue. The fire is lighted at the deeper end of trench, and the space occupied by the fire should not exceed 3½ feet. This is the simplest form of field cooking and was in vogue for many years; the utensils required were few, consisting of a nest of camp kettles, a small boiler, and perhaps a skillet or spider. If used for more than one night's camp the arrangement could be greatly improved. By this method of cooking practically no heavy equipment was required; therefore, no great tax upon transportation was made. It is the method upon which all troops eventually depend in war. The next step in field cooking was in the use of a range or oven, known as the "Buzzacott" (from the inventor of that name). It is an adoption of the Dutch-oven principle. It consisted of a large rectangular box, the box being made of sheet iron or steel, with a top of similar material. It was compact and strong. The outfit contained all the necessary utensils for every variety of cooking in the field for a company of 75 men. The next step in field cooking was a range, made to use wood. On account of its weight this range was abolished, and a new type substituted, which is now in use. Considerable improvement has been made, in order to enlarge the boiling space, and the present range is almost perfect for field service. The life of the present range is approximately two to six months. Owing to the great fire surface of the range, its bottom plate will soon burn out. Its equipment, as to utensils, is complete. The range alone weighs 145 pounds and its dimensions are 35½ by 25¼ by 17 inches. The weight of the range and equipment is 230 pounds. This range can cook for 111 men and is known as field range No. 1. Field range No. 2 has a capacity for 55 men. If pack-train transportation is used it can be transferred by pack mule. It can be set up in 15 minutes, including digging the trench, and can be taken down in 2 minutes.

The final article of the ration to be touched upon and the equipment pertaining to the preparation is, without doubt, the one in which the highest perfection has been attained. This article is bread. For generations the general assumption and expectation was that as as soon as troops passed into field service hard bread would be the article in generaluse, soft or fresh bread of any kind the exception.

There has always been an endeavor to supply soft bread to troops in the field, but only in the past few years has it been possible to do so. Of course, when troops are separated from the advance depots by great distances their ultimate dependence must be upon hard bread, but as long as regular supply trains are in contact with troops soft or field bread can be furnished.

The various classes of ovens that have been used in the United States Army in the past 50 years can be classified as follows:

1. *The Dutch oven.*—Two small vessels similar to two deep skillets are placed together. The dough is placed within vessel, the latter closed and heaped over with live coals. No extensive baking is possible in this way.

2. *Straight fire knockdown field oven.*—A hemisphere of metal in two parts are fitted together and covered with a jacket of earth, which forms an essential part of oven. The baking properties depend largely upon the heat-absorbing and radiating capacity of the material used.

Method of operating: Fire is built in the oven and drawn when the oven has been sufficiently heated for baking. After withdrawing the fire the oven is tightly closed for about an hour to allow proper distribution and equalization of heat. The oven is then ready to receive the dough. This is the form of oven that was used generally in the Civil War. Intermittent experiments were carried on for some years endeavoring to obtain a substitute for this oven, but the eventual result was to return to it as being the most generally satisfactory oven in existence. It was not until the years 1908 and 1909 that, due to the efforts of the Subsistence Department of the Army, an oven was developed that performed its functions better than the oven previously described, with greater capacity, and at the expense of about one-third the amount of fuel formerly consumed. This oven has sufficient capacity to supply bread for a regiment of infantry at war strength (1,600 men). The oven, having a capacity of 216 pounds of bread at one baking, with the ordinary force assigned turns out 1,512 pounds of bread per day. It was first planned to furnish one of these ovens and equipment to a regiment, but it was found from experience that the problem of supply could best be solved by the establishment of divisional bakeries.

A divisional field bakery, as the name implies, is capable of baking for a division consisting at war strength of 19,850 men, including line and staff. It consists of 12 field ovens, knockdown, the equipment for handling the dough, bread when baked, and necessary canvas for shelter, and field transportation, consisting of 12 wagons. These ovens with required equipment are capable of baking bread for a division consisting of 19,850 men under ordinary working condition and the personnel, consisting of 65 bakers, 4 cooks, and 12 teamsters. A division field bakery consists of four sections of three units each and are lettered A, B, C, and D, the units being numbered from 1 to 12. This formation provides for the detachment and assignment, when necessary, of one section to each of

the three brigades and one section to the artillery and organizations not brigaded. The formation of the section provides for the detachment and assignment, when necessary, of one unit to a regiment or an organization of corresponding strength. Field bakeries are so organized and equipped that each unit or section is complete in itself. Orders directing movement therefor simply specify the number of field bakeries, sections, or units required at a given place and the officer to whom to report. Under ordinary field conditions garrison bread will be supplied the troops, but if the bakery is too far away from the troops and it is necessary that bread should be transported by wagons or train it will be necessary to abolish the baking of garrison bread, and field bread will be supplied for the troops. As before mentioned, the capacity of a unit is 216 pounds per run, and 7 runs is considered a day's work. The capacity of a unit is cut down when field bread is baked from 216 pounds to 144 pounds per run, and the runs must be increased in order to bring the daily baking capacity to its original state.

FIELD BREAD.

This bread is intended to take the place of hard bread, and it answers the same purpose; that is, it is condensed under the smallest volume and least weight and contains all the nutritive elements of the flour and can be kept in a long period of preservation.

But, in the manufacture of field bread, it is sought to obtain a more digestible food than hard bread, more easily eaten and better liked by the troops. Field bread is porous in texture, and this facilitates its absorption of liquids and its mastication when dry, while it permits the taking of the gastric juices to a greater degree than hard bread. At a temperature of 37° C. field bread takes up four times its weight of water, while hard bread will take up only half as much. Plunged in boiling water field bread is soaked in 6 minutes, while hard bread requires more than 10. Finally, according to experiments, field bread contains a greater percentage of nitrogenous matter than does hard bread; it is more digestible and is more easily consumed.

Also, field bread is less subject to attacks from insects than hard bread; in the latter they develop quite readily, owing to its foliated texture. The insect, once admitted through any crack in the crust, easily gains the interior of the loaf and develops therein without hindrance, and no brushing can dislodge it. This the cellular structure of the field bread prevents. The external cracks are rare compared with the size of the loaf and the aeration holes throughout its surface. It is found, too, that a very prolific source of mold is the recrystallization of the salt, and it is sought to do away with this by

using perfectly pure salt and by straining the water in which it has been dissolved, so as to prevent any deposit therein. In its manufacture there are employed flour, water, salt, and grain yeast to the exclusion of sour dough or maiden yeast, which might give a tinge of bitterness to the bread. The flour employed should be of the best quality and should leave nothing to be desired in the matter of its state of preservation. It should be exclusively of soft wheat and bolted to 30 per cent and should not be less than 1 month and not more than 4 months old. Field bread requires an extremely stiff dough and should not be carried old.

The yeast is first dissolved in several quarts of water at a temperature not less than 35° C., rubbing between the hands until it yields an abundance of foam. The flour is then slowly added, and the mass is worked as in ordinary bread making. The yeast being thoroughly incorporated with the flour, the mass is deposited in any suitable receptacle, covered over, and allowed thus to remain a period of 30 to 40 minutes. The main point in field bread is to retain as much moisture in the finished product as is consistent with best keeping qualities. It should be thoroughly dry; that is to say, it should not have more than 13 per cent moisture, should not crumble, and should be sufficiently firm to resist the operation of packing and transportation. If for any reasons the bread has dried out too much and is too hard for ordinary purpose, it should be soaked in water for a few minutes (time of soaking depends entirely upon the size of the loaf), then baked in a hot oven, and the bread will take the appearance and taste of a fresh loaf of bread, but bread so treated must be eaten at once, as the process can not be performed the second time. Experiments with field bread have been made in the Army cooking and baking schools since the latter part of 1910, and the article was successfully used at various maneuver camps during 1911 and 1912. It is well liked by the soldiers, probably owing to the fact that it contains less crumb and more crust than the ordinary garrison bread, and is therefore easily digested. It has filled a long-felt want and great need and is without doubt one of the greatest steps ever made in the problem of proper feeding in the field.

The ration in general has been covered briefly in this article. I have endeavored to show the greatest improvements of recent years, but in the time allotted it is impossible to do the whole subject justice; however, the salient features have been covered. Our progress has been great in the last decade, especially so in the last five years. It is a subject worthy of great interest, of earnest efforts, and untiring zeal, for upon the proper subsistence of the soldier depends the efficiency of the Army. It is the foundation upon which our edifice is built.

GENERAL STATISTICAL DATA RELATING TO HEALTH CONDITIONS IN THE NAVY OF CHILE.

By Fleet Surgeon Maj. Alberto Adriasola, Chilean Navy.

The submission of these statistical data partakes only of the character of a general report on the prevalence of disease and mortality in the navy of Chile; therefore, we will not study those points of high interest to the hygienist who desires to ascertain the frequency of the diseases in the navy, their causes, and the conditions of their development and evolution, particularly and collectively, nor the form of prophylaxis of the diseases of an avoidable character. We wish merely to give information as to the diseases which present themselves in our navy, which consists of units of combat of different types, such as battleships, protected cruisers, wooden vessels, torpedo boats, etc., which are continuously plying up and down the long coast line of the Pacific, from the equatorial to the Antarctic waters which approach the Magellan region, Tierra del Fuego, and Cape Horn, in addition, there are constantly one or more vessels stationed on the southern coast engaged in hydrographic studies, while there are other school ships, which sail in every sea.

In order to attain our purpose, we have the honor to present these data corresponding to the last 10 years (1902–1911). Table No. 1 [1] shows the prevalence of disease during the period; table No. 2, the diseases observed during the same length of time; and table No. 3, the deaths which have occurred.

HEALTH STATISTICS.

The average number of men in the navy during the 10 years was 6,387.

The average number of sick per annum amounted to 7,028, which gives an average coefficient of sickness per annum of 1.167 per thousand.

The deaths which occurred numbered a total of 323, which gives an annual average of 32.3.

The prevalence of disease is so great (1.167 per cent) because the same person may report sick a number of times during the year, either with a different complaint or with a recurrence of the same disease.

As will be observed, the average annual mortality during the 10 years reached 5.1, which we may consider low in relation to that of the army on land, notwithstanding the numerous accidents on the sea, the hardships of living, and labor of sailors, which proves the good character of the sanitation on board.

This rate of mortality could have been even more favorable, but as will be observed in the years 1906 and 1911, the number of deaths was increased by the epidemic of smallpox, which swept the country at that time, and drowning accidents, which cost the lives of five cadets of the naval school.

The diseases which caused the deaths were, in the order of frequency, the following: Tuberculosis (pulmonary, pleural, and laryngeal), 51; typhoid fever, 25, a little less than 8 per cent.

These diseases caused real ravages throughout the country; but in recent years antituberculosis leagues have been established, due to private initiative, and the Government is causing public works of sanitation to be constructed in a large number of cities, for the purpose of improving their drainage and drinking water.

Broncho-pulmonary affections, all together, give a total of 42; that is to say, 13 per cent.

The rate of the prevalence of other diseases is such as not to be worthy of special remarks.

DISEASES OBSERVED.

The classification which we have adopted in our navy is the same as that adopted in the French Navy, and differs but little from the nomenclature of Prof. Bertillon, which is the official classification in the offices of medical statistics in the country.

The order of frequency of the occurrence of diseases, grouped according to our nomenclature, and which amounted to 70,409 cases in the 10 years covered by these data, is as follows:

I. Contagious and general diseases, 12,868, or 18.2 per cent of all cases observed.

IX. Venereal diseases, 11,907, or 16.9 per cent.

This high percentage in this group of diseases is explained by the fact that prostitution in Chilean ports is badly regulated, and by the fact that there exists also a large amount of clandestine prostitution which is absolutely beyond medical supervision.

With regard to individual prophylaxis, the entire personnel of the fleet receives instruction and treatment of a preventive character as often as possible; but, however, these measures do not give as good a result as could be desired.

XIV. Traumatic and surgical complaints, 10,503, or 14.8 per cent.

V. Diseases of the respiratory system, 8,618, or 12.2 per cent.

XII. Diseases of the skin, 8,272, or 11.7 per cent.

VI. Diseases of the pharynx, mouth, and esophagus, 3,133, or 4.4 per cent.

II. Animal parasites, 2,586, or 3.6 per cent.

The rate of the prevalence of the other groups of diseases is such as not to attract attention, as will be observed on the respective list.

In concluding these remarks, we take the liberty of expressing the opinion that the adoption of a uniform nomenclature by all nations would be very convenient in permitting the medical statistics of the same to be similar.

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[1] Since the main statistical facts are given in the paper, the publication of the more detailed statistical tables accompanying it was not deemed necessary.

STATISTIK ÜBER (EVENTUELLE) ZUNAHME DER BLINDDARMENTZÜNDUNGEN IN DER MARINE UND IHRE URSACHEN.

Marine-Oberstabsarzt Dr. Hennig, Berlin, Germany.

Die vielen in den letzten Jahrzehnten veröffentlichten Berichte über Blinddarmentzündung, ihre Ursache und Verbreitung und die gewaltige Zunahme, die diese Krankheit in den letzten Jahren anscheinend erfahren hat, geben mir Veranlassung, in dieser Hinsicht das Material der Kaiserlichen Marine zu prüfen.

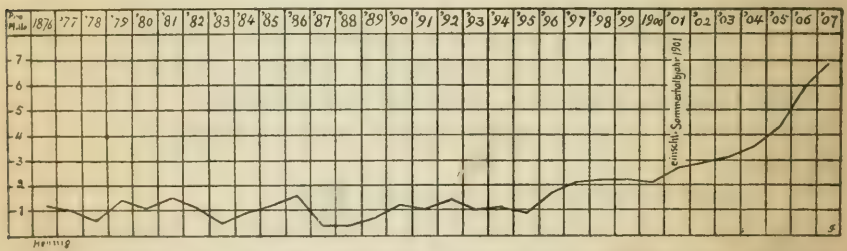
Die Fälle sind zur Beurteilung sehr günstig, da die Marinemannschaften sich unter ständiger ärztlicher Aufsicht befinden.

Es können somit die Ursachen der Krankheit, soweit sie sich auf äussere Einflüsse beziehen oder Folgen vorhergegangener anderer Krankheiten darstellen, hier besonders gut festgestellt werden.

Ferner eignet sich das Material, das aus den verschiedensten Gegenden der Erde stammt, sehr gut zur Entscheidung der Fragen, welchen Einfluss die Ernährungsweise, das Klima der einzelnen Länder und die Jahreszeiten auf die Entstehung der Krankheit haben.

Günstig zur Beurteilung der Fälle ist auch die Tatsache, dass die Marinemannschaften fast alle am Ende des zweiten oder am Beginn des dritten Lebensjahrzehntes stehen, einem Zeitraum, in dem bekanntlich Blinddarmentzündungen besonders häufig vorkommen.

Wie die Verhältnisse hinsichtlich der Vermehrung der Blinddarmentzündungen in der Marine seit dem Jahre 1876 liegen, darüber gibt folgende Kurve Aufschluss:



Wir sehen daraus, dass die Anzahl der Blinddarmfälle seit dem Jahre 1897 ständig und von Jahr zu Jahr mehr ansteigt. Wenn wir auch noch hören, dass jetzt die einzelnen Fälle im allgemeinen schwerer verlaufen als in den früheren Jahrzehnten, so müssen die Schädigungen die zur Blinddarmentzündung führen, entweder in vermehrtem Masse jetzt auftreten oder neue hinzugekommen sein.

Um hierüber Aufschluss zu bekommen, ist es nötig, auf die mannigfachen Ursachen, die Wurmfortsatzentzündung direkt oder indirekt hervorrufen, und auf die Sonderursachen, die eventl. für die Marine in Betracht kommen, genauer einzugehen.

I. INNERE URSACHEN, BEDEUTUNG DES BAUES DES WURMFORTSATZES FÜR DIE ENTSTEHUNG DER ERKRANKUNG.

Des Übels Wurzel liegt fast in allen Fällen in den mangelhaften anatomischen Verhältnissen des Wurmfortsatzes selbst, oder denen seines Mesenteriolums.

(*a*) *Länge.*—Wie folgende Übersicht über 231 Wurmfortsätze des vorliegenden Materials zeigt, ist die gröste Mehrzahl der Wurmfortsätze über 6 cm lang. Damit ist also auch in den meisten Fällen Gelegenheit zu Verbiegungen und Knickungen und dadurch bewirkten Verengerungen des Lumens gegeben, namentlich wenn noch ein zu kurzes Gekröse zur Knickung disponiert. Auch die mehr oder weniger ausgebildeten, an sich physiologischen Biegungen und Krümmungen—ganz gerade ist ja kein Wurmfortsatz—sind hierbei von Wichtigkeit, da hinter ihnen der Inhalt leichter zurückbleiben und stagnieren kann.

Länge.	3 cm.	4 cm.	5 cm.	6 cm.	7 cm.	8 cm.	9 cm.	10 cm.	11 cm.	12 cm.	13 cm.	14 cm.	15 cm.	16 cm.	17 cm.	20 cm.
Fälle.....	2	4	21	39	34	30	12	38	5	27	4	5	5	1	2	2

(*b*) *Enge.*—Dann spielt die lichte Weite dieses Organs eine grosse Rolle. Bei der grösseren Mehrzahl der Menschen der weissen Rasse ist das Lumen des Wurmfortsatzes eng, zwar nicht von Geburt an, denn in den ersten Lebensjahren ist dieser Darmanhang infolge wenig kräftiger Wandung und fast ganz flacher dünner Schleimhaut noch geräumiger, schlaffer und im Anfangsteil trichterförmig gebildet. Im Laufe der Zeit, wenn kräftigere, härtere Speisen den Darmkanal passieren und die Gerlachsche Klappe an seiner Mündung sich ausbildet, wird dann seine Wand stärker, die Schleimhaut dicker und faltiger und damit das Lumen enger. Auch die Muskulatur wird im Vergleich zur Lichtung eigentlich überstark und übt im Fall einer Verlegung der Mündung durch härtere Kotmassen auf den Inhalt einen so kräftigen Druck aus, dass unter Umständen die Schleimhaut an den nachgiebigen Eintrittsstellen der Blut- und Lymphgefässe verdrängt wird.[1] An diesen geschädigten Stellen können dann die Bakterien leicht einwandern.

Bei einzelnen Menschen bleibt aber der Wurmfortsatz relativ weit, und solche Anlagen sind, wie beobachtet, auch erblich. Diese Individuen sind dadurch gegen Blinddarmentzündungen geschützt, wie die Feststellungen Oberndörfers [2] an zahlreichem Leichenmaterial

ergeben haben. In solch besonders glücklicher Lage befinden sich vielleicht auch die Kamerunneger, denn bei einer Reihe von Wurmfortsätzen, die ich gelegentlich einer grossen Anzahl von Bauchoperationen im Regierungs-Hospital zu Duala im Jahre 1905 zu Gesicht bekam, fiel mir stets neben der Länge von 18–22 cm. und darüber auch die relative Schlaffheit und Dicke der Wurmfortsätze auf. Sie betrug in fast allen Fällen die eines kleinen Fingers. Entzündliche Erscheinungen irgend welcher Art waren daran selbst dann nicht uz finden, wenn im Körper, besonders in der Muskulatur, wahrscheinlich auch in den Därmen, zahlreiche Parasiten, namentlich Filarien vorhanden waren. Infolge ihrer Länge waren die Wurmfortsätze auch fast immer in einigermassen weiten Bruchsäcken, öfters sogar in solchen linksseitiger Leistenbrüche, aber stets ohne jede Spur von Erkrankung, zu finden.

Ich erwähne diese Beobachtungen, da namentlich Häberlein[3] darauf aufmerksam macht, dass bei den Naturvölkern wohl zweckmässigere Wurmfortsatzformen bestehen, dass aber bei den in den heutigen Kulturländern lebenden Menschenrassen infolge der vielfachen Rassenkreuzungen unzweckmässige Kombinationen von Wurmlänge, Form und Mesenteriolumbildung entstanden sind. Eine Auffassung, die meines Erachtens viel für sich hat. Zwar hat McLean,[4] der in Tsingtau viele Wurmfortsätze dortiger Chinesen bei Operationen bezw. Obduktionen gesehen hat, einen anatomischen Unterschied zwischen diesen und denen der weissen Rasse nicht feststellen können, nur die Tatsache, dass eben die chinesischen Wurmfortsätze ohne Krankheitserscheinungen sind, wie denn auch, dass Blinddarmentzündung bei den Chinesen unseres Schutzgebietes eine unbekannte Krankheit ist. In allerneuster Zeit sind aber doch auch Fälle von typischer Blinddarmentzündung bei Chinesen beobachtet.

Marine-Oberstabsarzt Dr. Podestà hat 1910 einen mit Abscedierung einhergehenden Anfall bei einem Chinesen im Schutzgebiet operiert, und ein zweiter Fall wurde an Bord des Loyddampfers *Coblenz* vom Schiffsarzt Dr. Lau auf der Fahrt von Hongkong nach Yokohama durch Operation gerettet und dann in Heilung dem Marine-Hospital Yokohama überwiesen. Also auch der Chinese scheint gegen Wurmfortsatzentzündungen nicht ganz gefeit zu sein.

(*c*) *Innerer Bau.*—Man nimmt auch an, dass der Follikelreichtum des Wurmfortsatzes einen Grund zur Entstehung der Appendicitis abgeben könne. Nach von Hansemann[5] entsteht dieser infolge Schwundes der specifischen Elemente, der Drüsen, in dem rudimentären Organ durch Näheraneinanderrücken der nicht specifischen, der lymphatischen Elemente. Eugen Albrecht sieht im Follikelreichtum eine Anpassung an die Lebensweise der Fleischfresser infolge Aufgabe der Rolle des resorbierenden Darmes und

Übernahme der eines lymphatischen Organes. Der Vergleich mit einem anderen lymphatischen Organ, den Mandeln, liegt nahe, aber doch besteht zwischen diesen und der Appendix eine grosse Verschiedenheit. Schon durch die Lücken im Epithel unterscheiden sich die lymphatischen Apparate der Tonsillen von denen des Wurmfortsatzes, dann fehlen hier auch die Mandelpfröpfe, von denen so häufig Anginen ausgehen. Appendicitis ist also nicht dasselbe, wie Angina tonsillaris, zumal auch in den anderen Darmabschnitten sehr viel ähnlich dicht stehende Lymphfollikel vorhanden sind, in denen sich die Angina auch nicht festsetzt.[6]

Die lymphatischen Elemente wirken aber meiner Meinung nach bei der Entstehung der Wurmfortsatzentzündung insofern mit, als sie infolge von Entzündungs-bezw. Toxinwirkung an einzelnen Stellen leicht anschwellen und so, das enge Lumen noch mehr verengernd zur Stauung des Inhalts führen können. Infolge dieser Stauung kann dann wieder Schädigung und teilweiser Verlust des Schleimhautepithels eintreten und dadurch der Bakterieneinwanderung ins tiefere Gewebe in reichem Masse Gelegenheit gegeben werden.

(*d*) *Beschaffenheit des Mesenteriolums.*—Zu dem Hauptfaktor "Enge des Organs" tritt noch ein anderer fast gleichwertiger, die Beschaffenheit des Mesenteriolums. Das Anhängeband des Wurmfortsatzes reicht in der Kindheit bis zu seiner Spitze, von der Zeit der Pubertät an findet dann aber ein allmähliches sich Zurückziehen statt. Zuweilen fehlt es auch ganz, und die ernährenden Gefässe verlaufen dann im Peritonealüberzug.[7] Hinsichtlich der Ernährung der Wände des Wurmfortsatzes sind diese Verhältnisse von grosser Bedeutung. Je länger sich das Mesenteriolum am Wurmfortsatz hinerstreckt, um so mehr Gefässe werden zu ihm hinziehen, und um so leichter werden auch Entzündungsprodukte weggeschafft; viel leichter jedenfalls, als in dem Peritonealüberzug, der in geschwollenem Zustand die in ihm verlaufenden Gefässe komprimiert. Ist das Mesenteriolum im ganzen oder an einzelnen Stellen kurz, d. h. ist der Zwischenraum zwischen seiner Wurzel und dem Ansatz am Wurmfortsatz kurz, so werden schon geringe Schwellungen und Verdickungen, wie sie durch Fettablagerung mit zunehmendem Alter entstehen, oder durch innere oder von aussen vom Blinddarm her fortgeleitete Entzündungsprocesse mit folgender Narbenbildung sich einstellen, von Einfluss auf die Haltung des Wurmfortsatzes selbst werden. Krümmungen, mehr oder weniger scharfe Abknickungen und Drehungen werden sich ausbilden, und diese leisten ihrerseits wieder der Entstehung, bezw. Weiterentwicklung der Wurmfortsatzentzündung Vorschub, insofern als sie zur Secretverhaltung, zu Störungen der Cirkulation in der Appendixwand und dem Mesenteriolum selbst führen. Knickungen entstehen andererseits auch

dadurch,[8] dass durch Zerrungen infolge Kürze des Mesenteriolums Schädigungen in der Wand des Mesenteriolums entstehen und von dort aus Entzündungen ausgehen, die bei Heilung Adhäsionen in geknickter Stellung bewirken. Zur Illustration dieser Verhältnisse lasse ich hier eine Tabelle folgen, die einen Überblick gewährt über 95 derartige Wurmfortsatzveränderungen, welche bei 437 Operationen in der Marine festgestellt wurden.

	Fälle.
Spitzwinklig geknickt	10
Abgeknickt im ersten Drittel	6
Abgeknickt im dritten Drittel	5
In der Mitte winkelig abgeknickt	12
Posthornförmig	4
S förmig	12
O förmig	3
C förmig	7
U förmig	2
⊜ aufgerollt	1
⋒ gewunden	2
Gekrümmt ohne Angabe der Form	13
Geknickt ohne Angabe der Stelle	18

Was die Lage der Wurmfortsätze anlangt, die Waldeyer nach folgendem Schema einteilt, und für die die entsprechenden, 231 Operationen berücksichtigenden, Zahlen eingetragen sind:

I. Hauptlagen.—(1) Nach dem kleinen Becken zu (physiologische Grundlage), 71; (2) nach innen vom Blinddarm, 37; (3) nach aussen vom Blinddarm, 27.

II. Nebenlagen.—(1) An der Hinterseite des Blinddarms (nächst der Lage nach dem kleinen Becken zu die am häufigsten vorkommende Lage), 63; (2) auf dem Blinddarm nach oben, 4; (3) nach vorn abwärts, 25; (4) in den Blinddarm eingestülpt; (5) mit dem Blinddarm nach der Magen- bezw. Lebergegend oder tief ins kleine Becken verzogen, 3; (6) in einem Bruch, so sind sie sowohl infolge der damit verbundenen Biegungen und Drehungen für die Entstehung der Appendicitis, als auch für den leichteren oder schwereren Verlauf der Krankheit und ihre Beziehung zu anderen Organen von Bedeutung. Fälle, bei denen der Wurmfortsatz nach vorn oder aussen gelegen ist, werden auch immer günstiger verlaufen, als solche, bei denen der Wurmfortsatz nach unten, hinten oder innen, womöglich zwischen Darmschlingen mehr oder weniger frei in die Bauchhöhle hineinragt. Soweit die inneren, durch die anatomische Beschaffenheit des Wurmfortsatzes bedienten Ursachen.

Was die äusseren Ursachen anbelangt, so wird zunächst die sitzende oder andauernd stehende Lebensweise angeschuldigt, welche leicht zur Obstipation und zu Stauungszuständen im Gefässsystem jener Gegend führt. Bei der Marine ist durch den allgemeinen Mangel an Bewegung an Bord der Schiffe, namentlich bei grösseren

Seereisen zu solchen chronischen Stauungen besonders Gelegenheit gegeben. Ausserdem ist hier noch ein anderer Punkt von Wichtigkeit. Da von den Mannschaften keine Hosenträger getragen werden, ist zum Halten des Beinkleides ein enger Hosenbund nötig. Dieser wirkt wie ein Gürtel bezw. wie ein Korsett und begünstigt durch die stete Compression gerade der oberen Blinddarmgegend eine andauernde Überladung und Erweiterung des Blinddarms, die secundär zu Reizungen an diesem Darmteil und seinem Anhang führen kann. Ein enges Koppel vermag unter Umständen eine ähnliche Wirkung auszuüben.

III. TRAUMA.

In einer Reihe von Fällen werden auch Gewalteinwirkungen auf die Blinddarmgegend als Ursache der Appendicitis angesehen, und diese sind von besonderem Interesse im Hinblick auf die Tatsache, dass der Wurmfortsatz durch seine Lage zwischen den lufthaltigen Därmen eigentlich sehr geschützt ist und infolge seiner Glätte leicht ausweichen kann. Die Gewaltwirkung durch Stoss muss schon sehr stark sein, und sich hinten bis auf die Wirbelsäule bezw. hintere Beckenwand fortsetzen, wenn sie dem gesunden Wurmfortsatz etwas anhaben will. Natürlich sind unter diesen Umständen Wurmfortsätze, die vorn oder an der Aussenseite des Blinddarms liegen, mehr gefährdet als solche, die mehr in der Tiefe gelegen sind. Immerhin aber bleibt diese rein traumatische Appendicitis, bei der Wurmfortsatz durch Fall oder Stoss direkt verletzt wird, eine seltene und schwer zu beweisende Krankheit. Eher tritt meines Erachtens eine Schädigung des Wurmfortsatzes durch das Trauma indirekt ein, insofern, als durch die Gewalteinwirkung auf die Blinddarmgegend der Blinddarm durch seinen Inhalt—seien es Gase oder feste Bestandteile, die wegen des Schlusses der Bauhinischen Klappe nicht nach rückwärts ausweichen können—plötzlich überdehnt wird. Diese starke Wandüberdehnung, die sich bis in den Wurmfortsatz hinein fortsetzt, kann zu einer heftigen Reizung bezw. zu kleinen Verletzungen der Wand des unteren Blinddarmendes führen. Der Reiz am Peritonealüberzug antwortet sofort mit einer geringen Exudatbildung, die an dieser Stelle des Körpers, wie man bie Operationen oft feststellen kann, besonders leicht stattfindet. Wohlgemuth[9] sieht die Ursache des Exsudats in der direkten Quetschung der ganzen Blinddarmgegend. Die entstandene Flüssigkeitsansammlung bereitet dann den Boden zur Einwanderung von Bakterien vor, bezw. bewirkt dei der Rückbildung durch Organisierung des Fibrins Verwachsungen, die zu secundärer Appendicitis Veranlassung geben können. Anders verhält sich beim Trauma der schon kranke Wurmfortsatz. Da treten die entzündlichen Erscheinungen bezw. Verschlimmerungen in der Regel sofort auf, insofern als durch die Quetschung und Überdehnung alte in dem

Gewebe ruhende Bakterien zu neuem Leben entflammt werden, dünne vor der Perforation stehende Wandstellen zerreissen, im Wurmfortsatz befindliche Kotsteine durchbrechen, Empyeme platzen, und Verwachsungen, die die Eiterherde umgeben, abgerissen werden können.

Wie aber schon gesagt, sind die ersten Anfälle, für die ein Trauma überhaupt verantwortlich gemacht werden kann, selten. Unter unserer grossen Zahl der Blinddarmentzündungen sind es nur 8, die auch noch nicht einmal mit Sicherheit, aber doch mit grösster Wahrscheinlichkeit als Unfallfolgen gedeutet werden können. Ich lasse sie hiermit folgen:

1) Schiffj. Fährmann wurde bei einer Prügelei an Bord mit der Unterbauchgegend gegen eine Geschützkurbel gestossen. Sofort traten heftige Schmerzen in der Blinddarmgegend auf, die während der Nacht sich noch verschlimmerten. Trotz reichlichen Stuhlganges hatte sich doch am dritten Tage eine Resistenz ausgebildet.

2) Mtr. Hug hatte sich beim Brotausladen an einem Handwagen den Unterleib an der rechten Seite gestossen. Bald darauf traten hier heftige, sich allmählich steigernde Schmerzen auf. Am nächsten Tag Stuhlverhaltung und nach zwei Tagen leichte Dämpfung.

3) Mtr. Pieper fiel an Bord aus einer Höhe von 6 Fuss mit der rechten Bauchgegend gegen eine Treppenkante und wurde besinnungslos. Seit der Zeit hatte ernoch nach einem Jahr heftige Schmerzen in der Blinddarmgegend.

4) Hzr. Loew fiel beim Sprung ins Wasser auf den Bauch und verspürte beim Schwimmen heftige Schmerzen in der rechten Unterbauchgegend, die sich in den nächsten Tagen noch vermehrten und zu Stuhlverhaltung und Resistenz führten.

5) Gftr. Roepke lief gegen einen Pumpenstiel und quetschte sich die rechte Seite des Unterleibs derartig, dass er ohnmächtig hinfiel. Nach einiger Zeit konnte er allein wieder aufstehen und sich ins Lazarett begeben. Das im Laufe desselben Tages sich einstellende Erbrechen und die heftigen Schmerzen in der Blinddarmgegend, zu denen in den folgenden Tagen Fieber, Stuhlunregelmässigkeiten und Resistenz kamen, sicherten die Diagnose Blinddarmentzündung.

6) Mtr. Poppe bekam beim Rudern mit einem Riemen einen Stoss gegen die rechte Unterleibsgegend, sodass er ohnmächtig wurde. Die betroffene Gegend wurde blutig unterlaufen. Seit jener Zeit hatte er hier immer leichte stechende Schmerzen und ausserdem häufige Stuhlunregelmässigkeiten, die später zu Blinddarmentzündung mit Resistenz führten.

7) Mtr. Koll lief mit der rechten Unterleibsgegend gegen den Knopf einer Treppenstütze. Während der nächsten Tage wurde die Blinddarmgegend immer empfindlicher, auch wurde mehrere Tage lang hier ein leichtes hautemphysemähnliches Knirschen

gefühlt. Der Stuhlgang wurde angehalten, und die Körperwärme stieg. Aber schon nach wenigen Tagen gingen die Erscheinungen der Blinddarmreizung zurück.

8) Mtr. Sieb zog sich durch Fall auf den Bauch heftige Schmerzen in der Blinddarmgegend zu, die nach vier Tagen langsam zurückgingen. Drei viertel Jahre später bekam er plötzlich bei der Kohlenübernahme wieder starke Schmerzen in der rechten Unterbauchgegend und Resistenz. Die Operation ergab alte leichte Verwachsungen mit dem Blinddarm in der Mitte des Wurmfortsatzes, entsprechend einer Wandverdickung und Lumenerweiterung.

Unter diese Gruppe gehören auch die Schädigungen des Wurmfortsatzes und seiner Umgebung, für die Überdehnung des Leibes bei Fehltritten oder Fall, Tragen und Heben schwerer Gegenstände, Überanstrengung beim Turnen und Springen u. s. w. verantwortlich gemacht werden. Die Häufigkeit derartiger Angaben von seiten der Kranken ergibt für 1,385 Fälle, deren Krankenblätter mir zur Verfügung standen, beifolgende Tabelle.

	Fälle.
Dehnung infolge Fehltritts oder Falles	5
Infolge schweren Hebens oder Tragens	42
Infolge Turnens oder Springens	13
Arbeiten in gebückter Stellung	8
Tragen enger Koppel beim Exerzieren	3
Summa	[a] 71

Sicher ist dabei wohl ein grosser Teil dieser Schädigungen mehr als ein zufälliges Ereignis im Beginne der Wurmfortsatzentzündung aufzufassen, das erst durch die Schmerzen den Betroffenen zum ersten Mal auf die schleichend entstandene Erkrankung aufmerksam gemacht hat.

IV. FREMDKÖRPER.

Als am Ende des vorigen und im Laufe dieses Jahrhunderts die Zahl der Blinddarmentzündungen zu steigen begann, und man die manigfachen Ursachen der Krankheit noch nicht kannte, mass man den vielerlei Fremdkörpern, die man im Wurmfortsatz gelegentlich fand, eine besonders grosse Wichtigkeit bei. Die Wände des Wurmfortsatzes sollten schon durch ihren Reiz allein sich entzündet haben und wenn man auch bei der Operation keinen Fremdkörper fand, so nahm man doch einen solchen als ursprüngliche Ursache der Entzündung an. Heute ist man anderer Ansicht und die Bedeutung der Fremdkörper wird nur sehr gering eingeschätzt. An sich finden sie sich im Wurmfortsatz schon selten, nur 8 mal = 1.8 Prozent bei den mir vorliegenden 437 operierten Fällen. Es waren dies 3 mal Haare, 2 mal Borsten von Zahnbürsten, 1 mal ein Steinstückchen, 1 mal

[a] 5.3 Prozent.

eine Bohne, und 1 mal der Stiel einer Vanillestange. Ihre Wirkung ist auch wohl meist nur die, dass sie bei bestehender Entzündung der Wand zur Verschlimmerung beitragen und nur in ganz seltenen Fällen eine direkte Verletzung der Wand hervorrufen können. Ein Beispiel hierzu bildet folgender, von mir beobachteter Fall. Es handelte sich um einen Wurmfortsatz, bei dem am Anfangsteil eine chronische Entzündung mit Verwachsungen bestand. In dem sonst gesunden letzten Dritte befand sich als Fremdkörper der 1 cm. lange, harte und scharfkantige Stiel einer Vanillestange, der wahrscheinlich durch peristaltische Bewegungen die Schleimhaut und Muskelschicht ca. 3 mm. breit durchrieben bezw. durchschnitten hatte. Die Wand war an dieser dicht neben dem Mesenteriolum gelegenen Stelle nur noch papierdünn und zeigte ausser leichter Serosainjektion keine schweren entzündlichen Erscheinungen. In wenigen Stunden wäre der Durchbruch lediglich mechanisch sicher ein vollkommener gewesen.

V. KOTSTEINE.

Weniger harmlos, als im allgemeinen die Fremdkörper, sind in ihren Beziehungen zur Erkrankung des Wurmfortsatzes, die Kotsteine. Ihre Entstehung ist zurückzuführen, einerseits auf verminderte Peristaltik des Darmes, insbesondere des Wurmfortsatzes bei chronischer Verstopfung. Dabei dickt sich die Kotsäule an einzelnen Stellen, meist aber in der äusseren Hälfte, leicht ein. Die harten Stücke nehmen dann rundliche Formen an und bleiben liegen, während die weicheren Kotmassen allmählich den Wurmfortsatz wieder verlassen. Andererseits können sich, und das gilt wahrscheinlich für den katarrhalisch bezw. entzündlich veränderten Wurmfortsatz besonders, um kleine Fremdkörperpartikelchen herum sich schichtend, Konkremente bilden, die aus Schleimhautprodukten und zahlreichen Bakterien vornehmlich bestehen. Noch sind die Meinungen über die Bedeutung der Kotsteine sehr verschieden, insofern als einige Autoren (Sprengel,[10] Aschoff [11]) der Ansicht sind, Kotsteine könnten ohne gleichzeitige Infektion lediglich mechanisch keine Wurmfort satzerkrankung hervorrufen, während andere, z. B. Klemm,[12] die Auffassung vertreten, dass ein Konkrement wohl den ersten Reiz abgeben könne, der zur Schwellung der Schleimhaut und dahinter zur Secretstauung führt. Eine dritte Ansicht ist die von Noll.[13] Nach ihr spielen Kotsteine und Kot bei der Entstehung der Entzündung nur insofern eine Rolle, als der Wurmfortsatz ähnlich wie bei Knickungen und Stenosen an der Entleerung seiner Absonderungen in den Darm gehindert wird. Der Stein selbst verletzt die Schleimhaut nicht und führt auch nicht zum Durchbruch.

Welche dieser, aus einem reichhaltigen Untersuchungsmaterial hervorgegangenen, Anschauungen die richtige ist—wahrscheinlich haben alle drei Theorien Recht—lässt sich wohl nie entscheiden, da

man im einzelnen Falle kaum jemals wird feststellen können, ob der Kotstein oder die Entzündung eher vorhanden war. Aber es steht fest, dass bei gleichzeitig vorhandenem Kotstein die Entzündungen am Wurmfortsatz, namentlich solche, die zur Gangrän führen, viel schneller und heftiger zu verlaufen pflegen, als wenn kein Stein mit im Spiele ist. Und die Frage, in welcher Weise diese Begünstigung der Entzündung und des Durchbrechens von seiten der Konkremente bewirkt wird, lässt sich nach Aschoff[14] dahin beantworten, dass sich die eingedrungenen Infektionskeime in den am hinteren Pol des Steines gestauten und an seinem vorderen Pol nicht genügend entfernbaren Schleimhautabsonderungen ansiedeln, dagegen die äquatorialen Bezirke des Steines, wo auch die Schleimhaut glatt und faltenlos anliegt, freilassen. Der Schutz der Mitte ist natürlich nicht dauernd, da die Entzündungen von den Seiten her auch allmählich fortschreiten. Die Entzündung hinter dem Stein ist aber wegen der auf die Nekrose sehr förderlich wirkenden Stauung des Inhalts am schwersten. Deshalb treten auch hinter dem Stein häufiger Perforationen ein (siehe unten). Gelegentlich kommt es aber auch zu Durchbrüchen vor dem Stein. Bei grösseren Konkrementen tritt infolge von Gefässschädigungen im Mesenteriolum, von Wandentzündungen und Thrombenbildungen, die von primären Herden ausgehen, öfters Totalnekrose der gespannten Wand an der dem Mesenteriolum abgewandten und mit Gefässen schlecht versorgten Seite ein. So entstehen die breiten Perforationen über dem Stein. Dass die Anwesenheit eines Kotsteins die Ausheilung von entzündlichen Processen im Wurmfortsatz durch seinen ständigen Reiz verhindert oder verzögert, ist ohne weiteres einleuchtend.

Die Grösse und Anzahl der meist länglich runden Kotsteine, die in 90 Fällen = 20.5 Prozent bei dem Material der Marine unter 437 Operierten vorkamen, ist natürlich sehr verschieden.

Folgende Tabellen geben darüber Aufschluss:

	Anzahl.
Reiskorngross	4
Erbsengross	33
Bohnengross	14
Mandelgross	2
Ohne Angabe der Grösse	37

	Fälle.
1 Kotstein	61
2 Kotsteine	14
3 Kotsteine	10
4 Kotsteine	2
5 Kotsteine	1
6 Kotsteine	1
12 reiskorngrosse Kotsteine	*1

Entsprechend auch anderen Beobachtungen fanden sich die Kotsteine im Endteil des Wurmfortsatzes am häufigsten, selten dagegen im Anfangsteil.

Am Anfang des Wurmfortsatzes wurden 2, in der Mitte 6, am Ende 20 gefunden.

*Der dünnwandige Wurmfortsatz hatte hadurch eine perlenschnurartige Form angenommen.

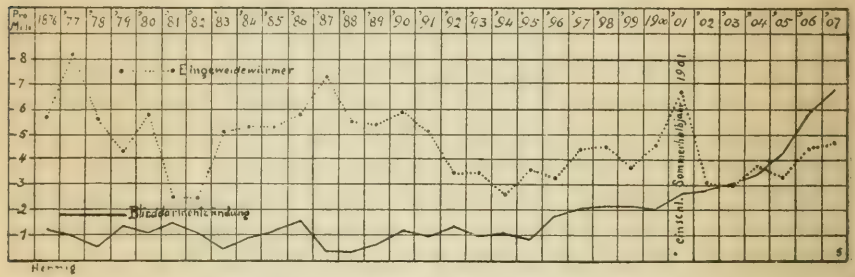
Der Grund hierfür ist wohl die am Ende wenig ausgiebige Peristaltik und die Behinderung der Entleerung durch Knickungen und Verwachsungen am Anfang und in der Mitte des Wurmfortsatzes.

Hinter einer verengten Stelle sassen 11 mal Kotsteine und 8 mal wurden solche im Eiter des Wurmfortsatzes schwimmend gefunden Ohne Angabe der Fälle sind 25 Fälle verzeichnet.

Was das Verhältniss der Konkremente zur Perforation anlangt, so fanden sich 11 mal die Kotsteine noch innerhalb des Wurmfortsatzes und 7 mal schon ausserhalb. In einem Fall bestanden zwei Durchbruchsstellen am Anfang und in der Mitte und vor ihnen im eitererfüllten Wurmfortsatz je ein bohnen- und erbsengrosser Kotstein.

VI. EINGEWEIDEWÜRMER.

Als dritter derartiger aetiologischer Faktor kämen die Eingeweidewürmer in Betracht. Die Meinungsverschiedenheiten der Autoren über ihre Bedeutung für die Entstehung der Wurmfortsatzenzün-



dung bestehen zwar immer noch, aber doch scheint die Ansicht, dass sie eine wesentliche Wirkung nicht haben allmählich durchzudringen. Hippius und Lewinsohn[15] haben allerdings einen capitalen Fall von Wurmerkrankung der Appendix veröffentlicht und für derartige Fälle muss ihrer Meinung über die schädigenden Einflüsse der Würmer wohl zugestimmt werden. Sie fanden bei einem mit ca. 80 Oxyuren vollgepfropften Wurmfortsatz die Schleimhaut gelockert und hyperämisch. Die mikroskopische Untersuchung ergab auch zahlreiche Verletzungen der Wand durch die bis zur äusseren Muskelschicht vorgedrungenen Oxyuren, sowie chronisch atrophische Processe in der Umgebung der kleinen Verletzungen. In einem solchen Falle könnten bei der Fülle des Infektionsmaterials in der Nähe Bakterien wohl freie Bahn ins Gewebe des Wurmfortsatzes erhalten. Beobachtungen von Wandverletzungen mit begleitenden geringen katarrhalischen Entzündungen durch Oxyuren sind häufig schon gemacht worden. Auch andere Würmer, wie Ascariden und Trichocephalus haben diese Eigenschaften (Leukart[16] und Ziemann[17]). Dass aber in den Bohrlöchern eine schwerere Infektion sich festsetzt und weiterschreitet, dafür wird sich in der Praxis ein Beweis kaum

erbringen lassen. McLean gibt an, dass fast jeder Chinese unglaublich grosse Mengen von Würmern in seinen Eingeweiden beherbergt und trotzdem niemals am Wurmfortsatz auch nur die geringsten Entzündungen hat. Dass im Innern dieses engen Organs gelegentlich hineingeratene, sonst übrigens unschuldige Bandwurmglieder, kleine Ascariden, bezw. grosse Mengen Oxyuren oder Trichocephalus durch ihre Bewegungen oder Anbohrungen kolikartige Schmerzen verursachen können, lässt sich natürlich denken.

Wenn auch, wie obige Tabelle zeigt, Eingeweidewürmer in der Marine sehr häufig vorkommen, so lassen sich doch aus dem reichhaltigen, mir vorliegenden Material nur 20 Fälle = 1.4 Prozent finden, in denen Erkrankung an Eingeweidewürmern der Blinddarmentzündung kürzere oder längere Zeit vorangegangen war, bezw. bei denen Eingeweidewürmer bei der Operation festgestellt wurden. Es waren dies 9 mal Bandwürmer, 4 mal Spulwürmer und 2 mal Eingeweidewürmer (ohne weitere Bezeichnung). Bei den 437 Operierten fanden sich gar nur 5 mal Parasiten und zwar 1 mal im sonst gesunden Wurmfortsatz ein sehr lebhaftes Glied von *Tænia saginata* (Tsingtau), 3 mal im Abscesseiter eines perforierten Wurmfortsatzes ein Glied von *Tænia solium* (Heimat) 1 mal im Wurmfortsatz vier Oxyuren.

Nach diesen Ergebnissen muss man wohl sagen, dass die Eingeweidewürmer nur eine sehr nebensächliche Bedeutung haben können.

VII. INFECTIONSKRANKHEITEN.

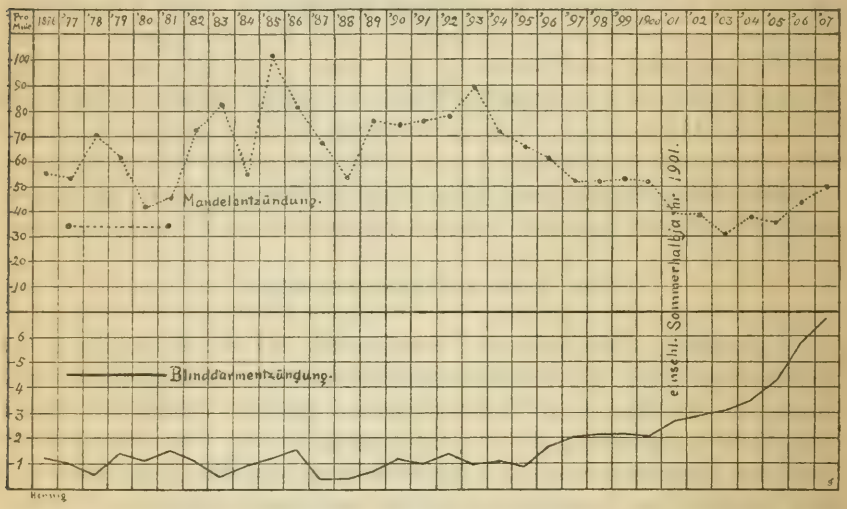
(*a*) *Angina.*—Eine weitere Veranlassung für die Entstehung der Appendicitis sind die Infektionskrankheiten und die häufigste von ihnen, die Angina, ist wohl im Gedanken an die Ähnlichkeit beider Krankheiten zeitweilig als die Hauptursache der Wurmfortsatzentzündung angesehen worden. Verschluckte oder durch das Blut von den Mandeln her verschleppte Infektionserreger sollen die Entzündung bewirken.

Die Tatsache, dass im Material der Marine in 70 Fällen = 5.1 Prozent (für 1,385 Fälle), Angina der Appendicitis vorher, in 33 Fällen = 2.4 Prozent nebenher gegangen und in 6 Fällen = 0.4 Prozent der Krankheit unmittelbar gefolgt ist, könnte diese Ansicht unterstützen; Aber die Berücksichtigung des Zahlenvergleiches, der gleichzeitig auf die Häufigkeit der Mandelentzündung entsprechend der vermehrten Erkältungsgelegenheit hinweist, spricht doch sehr zu Ungunsten dieser Theorie. Denn gerade mit dem Ansteigen der Blinddarmentzündungen während der Jahre 1901–1905 geht ein Abfallen der Mandelentzündungen parallel und umgekehrt auch in Jahren, wo viel Mandelentzündungen vorkamen, mehrte sich nicht auch entsprechend die Zahl der Blinddarmentzündungen.

Eine wesentliche Bedeutung lässt sich also auch der Angina nicht beimessen.

b) *Bronchialkatarrh.*—Ähnlich verhält es sich mit dem Bronchialkatarrh, der in 56 Fällen = 4.04 Prozent eben vorher oder neben der Blinddarmentzündung verlief und kurz hinterher 13 mal vorkam. Auch hier spielt die Inficierung des Wurmfortsatzes durch verschluckten Auswurf bezw. durch Übertragung auf dem Blutwege kaum eine Rolle. Wohl aber ist die Krankheit von Bedeutung, insofern als die Kranken durch die Hustenstösse erst auf den Schmerz in der Blinddarmgegend aufmerksam werden und die schleichend beginnende Entzündung des Wurmfortsatzes dann durch die Erschütterung ungünstig beeinflusst werden kann.

c) *Pneumonie.*—Da auch nicht selten Pneumococcen im Wurmfortsatz selbst, wie auch im Exsudat gefunden werden, liegt der Gedanke



nahe, dass vielleicht der Pneumonie gelegentlich ein Einfluss auf die Entstehung der Blinddarmentzündung zuzuschreiben sei. Aber wie folgende, 1,385 Fälle berücksichtigende Übersicht zeigt, kommt Pneumonie als vorhergehende Krankheit nur selten vor.

Pneumonie haben durchgemacht vor den ersten Anfällen:

Vier Monate vorher, 2 Leute, 1 operiert (Abscessöffnung).

Zehn Monate vorher, 2 Leute, nicht operiert.

Ein Jahr vorher, 2 Leute, nicht operiert.

Zwei Jahre vorher, 2 Leute, nicht operiert.

Drei Jahre vorher, 4 Leute, davon 1 operiert im Frühstadium. (Wurmfortsatz war 2 mal geknickt und zeigte geringe Injektionen der Schleimhaut und 1 Kotstein.)

Vier Jahre vorher, 1 Mann, operiert im Zwischenstadium (alte Verwachsungen).

Als Kind, 5 Leute, 3 nicht operiert, 2 operiert im Spätstadium (davon hatte 1 alte Verwachsungen, 1 einen grossen Abscess).

Summa, 18 Fälle = 1.3 Prozent.

Auch muss es durchaus als zweifelhaft erscheinen, ob die in der Tabelle eingetragenen Operationsbefunde durch die Pneumonieerreger veranlasst sind. Direkt vor dem ersten Anfall ist überhaupt kein Fall von Pneumonie vorangegangen, wohl aber wurden einmal im Wurmfortsatz reichlich Pneumococcen gefunden, ohne dass überhaupt Beziehungen zur Pneumonie bestanden. Ein Beweis für den ätiologischen Zusammenhang beider Krankheiten ist somit ebenfalls nicht zu erbringen.

d) *Influenza.*—Trotz der Seltenheit einschlägiger bakteriologischer Befunde (Corbellino [18]) hält doch noch eine grosse Reihe von Autoren (Welsch,[19] Gelpke,[20] Heist,[21] Kümmel,[22] Karrenstein,[23] Friedjung,[24] u. a. [25], [26], [27]) im Gegensatz zu Rostowzew, Scholz und Sprengel ander Meinung fest, die Influenza sei sehr häufig die Ursache der Appendicitis und durch das Ansteigen der Influenzafälle während der Epidemieen sei auch das Ansteigen der Blinddarmentzündung erklärt. Dieser Theorie widerspricht unser Material vollkommen.

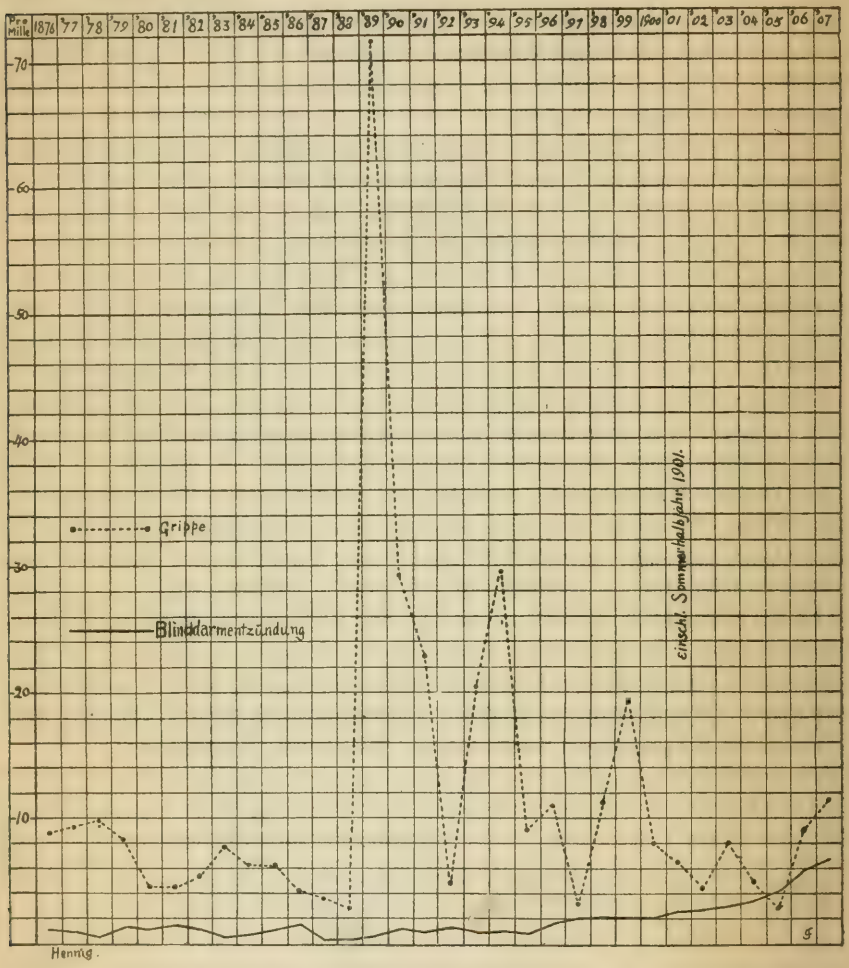
Wie aus dem Zahlenvergleich hervorgeht, waren die ersten Anfälle der Appendicitis gerade sehr gering in den Jahren, wo die Influenzafälle in vermehrter Menge vorkommen und ebenso umgekehrt. Auch der Hinweis Karrensteins, dass bei der Armee in den Wintermonaten, in denen die Influenza am häufigsten vorkommt, ebenfalls eine Zunahme der Appendicitisfälle stattfand, findet in der Marinestatistik keine Analogie. Hier steigt im Monat Dezember die Kurve der Blinddarmerkrankungen nur wenig an, um in den übrigen Wintermonaten jedoch abzufallen, während die hauptsächlichsten Influenzamonate gerade November, Dezember und Januar sind. Ausserdem ist unter 1,385 Ersterkrankungen überhaupt nur 20 mal = 1.4 Prozent Grippe vorhergegangen und zwar in folgenden Zeiträumen:

	Fälle.
Bis zu 1 Jahr	7
1 Jahr	3
2 Jahr	6
3 Jahr	2
5 Jahr	1
6 Jahr	1
Summa	20

Also auch die Influenza erklärt das Ansteigen der Blinddarmentzündungen nicht.

e) *Darmkatarrhe.*—Was die Darmkrankheiten anlangt, so wird vielfach (Karewski,[28] Lennander,[29] Welsch,[30] Soupault und Menard[31]) den infektiösen Darmkatarrhen eine grosse Bedeutung für die Aetiologie der Appendicitis beigelegt, insofern als der Krankheitsprocess

auf den Wurmfortsatz übergreift, sich dort entsprechend den örtlichen Verhältnissen weiter entwickelt und in der Wand Schädigungen bewirkt. So werden auch die Darmkatarrhe des Kindesalters namentlich von französischen Ärzten als sehr verhängnisvoll angeschuldigt. Wie wir später sehen werden, ist für unsere Fälle der Monat August derjenige, in dem am häufigsten die ersten Anfälle



der Blinddarmentzündung auftreten. Bekanntlich kommen ja in den Sommermonaten auch die Darmkatarrhe am häufigsten vor. Man sollte also denken, dass hier wieder ein Zusammenhang beider Krankheiten besteht.

Allein die Vergleiche der Jahreszahlen beider Krankheiten ergeben bei der sehr grossen Menge der Darmkatarrhe nur erstaunlich wenige Blinddarmentzündungen und auch sonst stehen beide Krankheiten in gar keinem Verhältnis zueinander.

In allen Erdteilen haben unter 1,385 I. Anfällen von Blinddarmentzündung Darmkatarrh gehabt:

Jahr.	Bis 1 Jahr vor dem Anfall.	Über 1 Jahr vor dem Anfall.
1877	1	.....
1878	1	.....
1890	1	.....
1892	1	.....
1896	2	.....
1897	3	.....
1898	6	.....
1899	3	1
1900	9	1
1901	2	3
1902	4	7
1903	4	2
1904	7	4
1905	1	4
1906	25	4
1907	9	10
Summa..	79 Mann.	36 Mann.
Prozent..	5.7	2.6

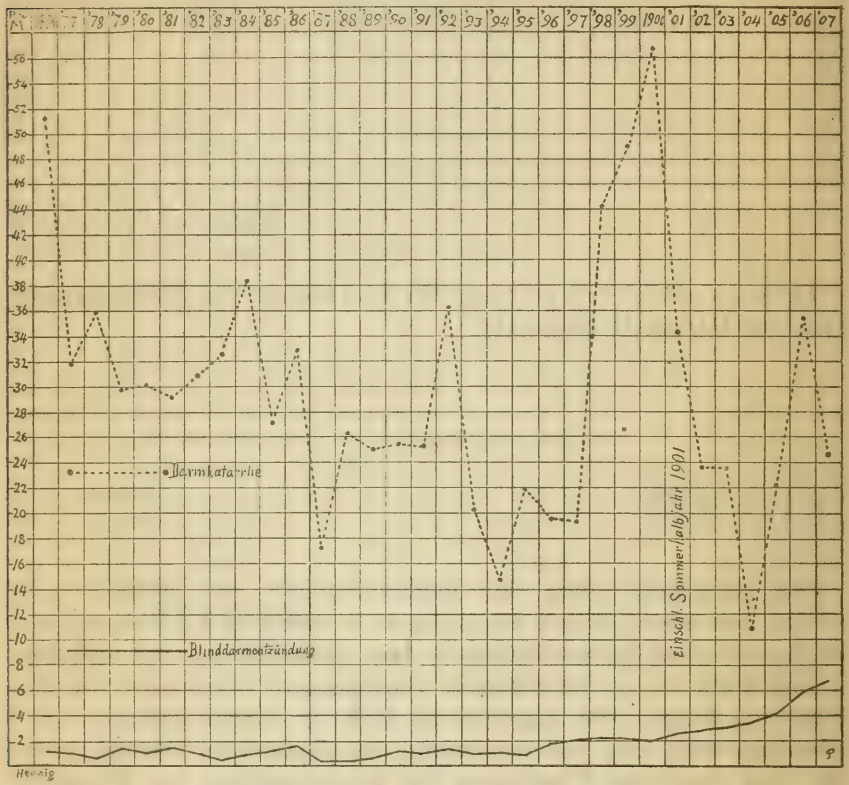
In Asien allein haben unter 253 I. Anfällen von Blinddarmentzündung Darmkatarrh gehabt:

	Jahr—										Prozent.
	1898	1900	1901	1902	1903	1904	1905	1906	1907	Summa.	
Bis 1 Jahr vor dem Anfall.	5	5	2	.....	2	4	1	16	5	40 Mann.	15.8
Über 1 Jahr vor dem Anfall	.....	.....	1	4	.....	2	1	.....	4	12 Mann.	4.7

Die Berücksichtigung der Zahlenübersicht der Darmkatarrhe, welche dem ersten Anfall vorangingen, es sind nur 8.3 Prozent, lässt zu dem gleichen Schluss kommen, dass eigentlich nur für auffallend wenige Fälle ein vorhergehender Darmkatarrh überhaupt von Einfluss sein kann. Die Appendicitis stellt in diesen seltenen Fällen allerdings wohl eine Teilerscheinung des allgemeinen Darmkatarrhes dar oder durch das Uberstehen des Darmkatarrhes des Wurmfortsatzes werden in seiner Schleimhaut bezw. Gefässen oder in der Umgebung eventl. Schäden gesetzt, die später zur Entwickelung der Appendicitis führen können.

f) Ruhr.—Folgende Tabelle, der vor dem ersten Blinddarmanfall überstandenen Ruhrerkrankungen zeigt, dass bei unserm Material nur 1.4 Prozent der Kranken Beziehungen zur Ruhr haben. Zum grossen Teil sind diese auch nur sehr ferne. Eine Statistik McLeans, die allerdings die Ruhr und Darmkatarrhe zusammenfasst, kommt zum gleichen Resultat. Hiernach waren von den 146 Blinddarmentzündungen, die in den Jahren 1903–1907 in Tsingtau zur Operation kamen, nur 9 in unmittelbarem Anschluss an Ruhr oder Darmkatarrh entstanden. 37 mal (=253 Prom. für die Operierten) waren diese

Krankheiten bei den gleichen Leuten überhaupt vorhergegangen. Wenn man bedenkt, dass jedes Jahr ein Drittel oder die Hälfte der ganzen Garnison Tsingtau an Ruhr und Darmkatarrh leidet, ist es doch eigentlich ausser ordentlich selten, dass Blinddarmentzündungen sich nach Ruhr oder Darmkatarrh einstellen. Bei seinem Material hat McLean nur einmal ein Übergreifen klinisch typischer Ruhr auf den Wurmfortsatz gesehen, und zwar bei einem 11jährigen



Knaben, dessen Wurmfortsatz ein sehr weites, trichterförmiges, für den kleinen Finger bequem durchgängiges Lumen zeigte.

	Fälle
Bis zu 1 Jahr vorher haben Ruhr gehabt	
1 Jahr	4
2 Jahr	2
4 Jahr	2
5 Jahr	3
6 Jahr	2
Summa	19

g) *Typhus.*—Für ganz seltene Fälle kommt nach den Veröffentlichungen von Behrend,[32] Stokes und Amick,[33] Moty,[34] und Hoke,[35] der Typhus in Betracht, insofern als diese Krankheit gelegentlich so

wie Darmkatarrh und Ruhr auf den Wurmfortsatz übergehen und dort Schädigungen hinterlassen kann, die einer späteren Wurmfortsatzentzündung das Feld ebenen. Im Marinematerial findet sich Typhus 16 mal = 1.2 Prozent als vorhergehende Krankheit.

	Fälle.
Bis zu 6 Monaten vorher	2
Über 6 Monate	1
1 Jahr	2
3 Jahr	3
4 Jahr	2
5 Jahr	1
6 Jahr	2
8 Jahr	1
9 Jahr	2
Summa	[a] 16

Die beiden ersten Fälle dieser Liste entstanden direkt im Anschluss an die Krankheit in Tsingtau in den Typhusjahren 1899–1900 und verliefen leicht. Nur ein Fall hatte Fieber, der andere zeigte eine geringe Anschwellung in der Tiefe der Blinddarmgegend. Als sonstige Krankheitssymptome bestanden bei beiden Schmerzen im ganzen Dickdarm, hauptsächlich aber in der Blinddarmgegend.

Ob es sich in diesen beiden Fällen um typische Wurmfortsatzentzündungen oder nur um Typhusresiduen hauptsächlich in der Blinddarmgegend, gehandelt hat, scheint zweifelhaft.

Die andern Fälle ergeben überhaupt keine Anhaltspunkte, die einen bestimmten Zusammenhang zwischen beiden Krankheiten rechfertigen könnten.

Wie aus Vorhergehenden ersichtlich ist, spielt keine der Infektionskrankheiten, die in Betracht kommen könnten, eine wesentliche Rolle für die grössere Allgemeinheit der Blinddarmentzündungen; dagegen ist anscheinend, obwohl vielbestritten, doch die Tuberkulose noch von besonderer Wichtigkeit für die Aetiologie.

h) *Tuberkulose.*—Wie die Bronchialdrüsen, so sind auch die Drüsen der Blinddarmgegend ein Prädilektionsort für das Festsetzen der Tuberkelbazillen infolge der häufigen Stauungen des Blinddarminhalts und des wahrscheinlich dadurch auch verminderten Blutkreislaufs in der Darmwand.

Um über die Tuberkulose-Frage Klarheit zu gewinnen, habe ich seit einiger Zeit jeden Blinddarmfall im Marinelazarett Wilhelmshaven möglichst genau auf tuberkulöse Symptome untersucht und die Vorgeschichte bezw. tuberkulöse erbliche Belastung genau festgestellt.

Seit Beginn dieser Specialuntersuchungen waren es im ganzen 37 Fälle, die zur Operation kamen. Die Resultate hierüber gebe ich in folgendem vorläufig wieder.

[a] 1.2 Prozent.

Vorgeschichte.—Erblich mit Tuberkulose belastet von seiten der Familie waren 12 = 32.4 Prozent (der 37 Fälle).

Selbst Tuberkulose in der Jugend durchgemacht hatten 4 = 10.8 Prozent.

Befund.—Sichere Zeichen von Tuberkulose in der Blinddarmgegend in Gestalt von tuberkulösen verkalkten bezw. verkästen Drüsen hatten 8 = 21.6 Prozent; davon waren erblich belastet 3; hatten in der Jugend Tuberkulose durchgemacht, 4.

Drüsen-Vergrösserungen bezw. Schwellungen meist mit umgebender Narbenbildung am Blinddarm, Wurmfortsatz und Gekröse hatten 16 = 43.2 Prozent.

Keine vergrösserten Drüsen hatte, obwohl erblich belastet 1 = 2.7 Prozent (wegen Abscess nach Drüsen nicht nachgesehen wurde bei 6 = 16.2 Prozent; aus anderen Gründen nach Drüsen nicht nachgesehen wurde bei 6 = 16.2 Prozent).

Mithin erwies sich bei genauer Nachforschung als erblich belastet fast die Hälfte und mit noch bestehenden sicheren Zeichen von Tuberkulose behaftet, ein Fünftel der Fälle.

Tuberkulose am Wurmfortsatz selbst bezw. Tuberkelbazillen in ihm nachzuweisen, ist mir in diesen Fällen nicht gelungen, der Nachweis gelingt auch nur selten. Müller [36] fand bei genauer histologischer Untersuchung unter 310 Wurmfortsätzen überhaupt nur 6 mal Tuberkulose in der Wurmfortsatzwand und berechnete nach einer Zusammenstellung grösserer Statistiken von 3,000 Operierten nur 1.6 Prozent Tuberkulose. Das liegt daran, dass die Tuberkelbazillen vom Darm aus auf dem Lymphwege in die mesenterialen Drüsen einwandern, fast immer ohne an der Eingangsstelle, ähnlich wie an den Mandeln, irgend welche Veränderungen zu hinterlassen. Nur selten führen sie zu tieferen Schleimhautgeschwüren im Blinddarm und dem benachbarten Dünndarmende. In den im Winkel zwischen Dünndarm und Blinddarm, hin und wieder im Mesenterium des Wurmfortsatzes, aber auch an der Innenseite des Blinddarmgekröses und innerhalb der Serosa des Blinddarms manchmal in grosser Menge gelegenen bezw. gebildeten Lymphdrüsen werden die Tuberkelbazillen festgehalten. Sehr virulent und lange lebensfähig scheinen sie im allgemeinen nicht zu sein, da der Process nur sehr langsam verläuft und die Bacillen leicht überwunden werden, indem sie in den Drüsen der Einkalkung anheimfallen, oder sonst vernichtet werden, wie die hypertrophischen, mit stark vermehrter Bindegewebsbildung einhergehenden Processe in den Mesenterialdrüsen vermuten lassen. An der Vernichtung der Tuberkelbacillen beteiligt sich überhaupt die ganze Umgebung, denn schon auf ihrem Weg durch die Lymphgefässe geben sie, wohl infolge ihrer nur anfangs bedeutend toxischen Eigenschaften Anlass zur Infiltration und Bindegewebsbildung in der Nachbarschaft. Es entstehen durch diesen Entzünd-

ungsprocess, der hauptsächlich in der Serosa und Subserosa verläuft, und durch den ständigen Reiz, den tuberkulöse Drüsen auf die Nachbarschaft ausüben, kleinere Exudate, Narben und Schwarten in der weiteren Umgebung. Diese führen ihrerseits wiederum zu Abknickungen und zu Gefässstörungen am Wurmfortsatz, so dass dieses schon an und für sich schwächliche Organ kommenden Infektionen gegenüber in seiner Widerstandskraft geschädigt wird.

Schon häufiger wurde der Verdacht auf einen Zusammenhang von Tuberkulose der Blinddarmgegend insbesondere der dortigen Mesenterialdrüsen mit Wurmfortsatzentzündung ausgesprochen. Im Jahre 1904 machten Heller [37] und in letzter Zeit namentlich Corner,[38] Vautrin,[39] Fiori,[40] Els,[41] Thiemann,[42] auf die Bedeutung der Ileocoecal-Tuberkulose aufmerksam. Dass aber Tuberkulose und Reste von früheren Tuberkuloseerkrankungen in der Blinddarmgegend so häufig, wie in obiger kleinen Statistik vorkommt, ist bisher anscheinend nicht beobachtet. Ich glaube der Grund hierfür ist der, dass die Operateure, um die Operationen nicht zu verlängern, sich in der Regel damit begnügen, den Wurmfortsatz zu entfernen und eventl. sein Mesenteriolum zu besichtigen, nicht aber auch die weitere Umgebung untersuchen und auf Drüsen an den angegebenen Stellen fahnden. Mit der Entfernung des Wurmfortsatzes ist wohl die Gefahr, die von diesem droht, beseitigt, aber der tuberkulöse Herd in der Nachbarschaft, der nicht immer abgestorben ist, kann sich eines Tages wieder regen und zu neuen Entzündungen in der Umgebung oder zur Weiterverbreitung in andere Organe Anlass geben. Deshalb ist die Entfernung kranker Ileocoecaldrüsen bei der Operation des Wurmfortsatzes dringend geboten.

VIII. ERNÄHRUNGSWEISE.

Bei der Entstehung dieser Tuberkulose spielt natürlich die alimentäre Infektionsart die wichtigste Rolle. Auch hierfür sprechen obige Fälle, insofern, als von den Leuten 20 schon von Kindheit an mit besonderer Vorliebe rohe Milch getrunken hatten. Ungekochte oder mangelhaft sterilisierte Milch wird ja bekanntlich als eine der häufigsten Ursachen der Darmtuberkulose angesehen. Von diesen 20 Leuten hatten 4 sichere tuberkulöse Drüsen und 15 vergrösserte bindegewebsreiche Drüsen. Einer dieser Fälle wies besonders viel verkäste und verkalkte Drüsen auf, die wie Perlenschnüre angeordnet lagen und vom Blinddarmmesenterium bis zum Wurmfortsatz reichliche Narben gebildet hatten. Der betreffende Mann war von Beruf Molkereigehülfe und als solcher durch ständigen Genuss roher Milch einer Tuberkuloseinfektion stark ausgesetzt gewesen.

Wie der Genuss roher Milch indirekt also zur Blinddarmentzündung führen kann, so hat auch sonst die Ernährungsweise wohl den grös-

sten Einfluss auf die Entstehung der Krankheit. Eine Diät, die in der Hauptsache Fleisch enthält, führt, wie bekannt, zur Obstipation und durch das allzu lange Verweilen des Inhalts im Darm zu Entzündungen der Darmwand, die sich häufig in schleimigem Dickdarmkatarrh (Colitis mucosa, Enteritis membranacea) äussern. Entzündungen der Darmwand ihrerseits können, wie wir bereits bei den Infektionskrankheiten gesehen haben, am Wurmfortsatz infolge Schwellung der Schleimhaut Biegungen verursachen und in einem Teil der Fälle wohl durch Toxinwirkungen zu Exsudatbildungen führen, die ihrerseits mit Verwachsungen bezw. Narbenbildungen in der Blinddarmgegend endigen. Durch diese ist dann der Wurmfortsatz gewissermassen gebunden und gegen spätere Infektion wehrlos gemacht.

Vegetabilische Kost dagegen vermeidet, trotz der zur Ernährung erforderlichen grösseren Quantitäten, die Verstopfung mit den in ihrem Gefolge auftretenden Darmkrankheiten und schützt anscheinend auch vor Wurmfortsatzentzündungen. Völker, die sich in der Hauptsache durch Pflanzenkost ernähren, bleiben nachweislich davon frei, wie z. B. die Reis essenden Chinesen oder die auf vegetarische Lebensweise angewiesenen Naturvölker.

Bei Völkerstämmen, die mit der Kultur auch den Fleischgenuss übernahmen, hat erwiesenermassen auch die Wurmfortsatzentzündung gleichzeitig ihren Einzug gehalten, wie dies z. B. bei den Japanern (Sonnenburg)[43] der Fall war. Ich verweise auch hier nochmals auf die anfangs erwähnten beiden Fälle von Appendicitis bei Chinesen.

Auch sind die Erkrankungen an Blinddarmentzündung erschrecklich hoch in Gegenden, wo durch Fleischgenuss, namentlich dem Genuss sog. englisch zubereiteten, rohen bezw. halbrohen Fleisches die Haupternährung stattfindet, wie in England, Nordamerika, und Norddeutschland, besonders Hamburg. Andererseits kommt in den Städten, wo natürlicherweise der Gemüsekonsum geringer und der Fleischkonsum höher ist, als auf dem Lande, auch die Blinddarmentzündung entsprechend häufiger vor. Für unsere Marine ist diese Tatsache insofern von Bedeutung als auch öfters Leute, die aus Gegenden stammen, in denen die vegetabilische Ernährungsweise vorherrscht, kurz nach ihrer Einstellung in die Marine, nach dem sie also kurze Zeit der Wirkung des erhöhten Fleischgenusses ausgesetzt waren, an Blinddarmentzündungen erkranken. Wie gross überhaupt das Verhältnis des Fleischgenusses zur Blinddarmentzündung ist, zeigt sich aus folgender Zusammenstellung. Von 50 in der letzten Zeit von mir operierten Blinddarmkranken geben 35 an, starke Fleischesser zu sein, insbesondere auch rohes Fleisch gern zu geniessen. Nur einer war ein mässiger Fleischesser und 14 behaupten an Fleischkost nicht gewöhnt zu sein. Also auch hier die hohe Zahl von 70 Prozent starken Fleischessern.

Wenn wir nun auch bedenken dass infolge der Verkehrserleichterungen und verbesserten Kühlvorrichtungen heutzutage Fleisch einen viel grösseren Konsumartikel darstellt, als es früher der Fall war, so berechtigt dies zu dem Schluss, dass in dem heute noch immer sich steigernden Fleischgenuss wohl die häufigste Ursache der auch ständig sich vermehrenden Blinddarmentzündungen zu suchen ist.

IX. EINFLÜSSE EINZELNER ERDTEILE.

Es bleibt nun noch die Frage, ob der Aufenthalt unter dem einen oder anderen Himmelsstrich zu vermehrter Blinddarmentzündung führt, und ob klimatische Verhältnisse auf die Entstehung der Krankheit einen Einfluss haben können.

	Absolut.	Pro Mille.	Besatzungsstärke.
Europa	1,016	1.8	552,148
Asien	253	2.9	85,756
Afrika	27	1.3	20,251
Amerika	32	0.9	36,056
Südsee und Australien	3	0.3	11,376
	1,331	.....	705,587

Die Tabelle zeigt die Verteilung von 1,331 ersten Anfällen auf die einzelnen Erdteile, in denen sie entstanden sind. Den geringsten Procentsatz (0.3) ergeben hiernach die Südseeinseln mit Australien. Die Gründe hierfür sind sicher folgende: Auf diesen Inseln ist mit Ausnahme von Australien frisches Fleisch sehr selten und teuer, während die vielen Sorten vortrefflicher Früchte ich nenne nur Bananen, Ananas und Mangos, sehr billig sind. Infolgedessen werden auch auf unseren Schiffen dort im allgemeinen nur verhältnismässig wenig Konservenfleisch und ganz selten Frischfleisch, dagegen mehr die guten Konservengemüse und hauptsächlich Früchte genossen, letztere in grösseren Mengen besonders auch ausser den Mahlzeiten. Im Kiautschougebiet, auf das der grössere Procentsatz der Blinddarmfälle in Ostasien kommt (3.8 Pro Mille) ist gerade das Umgekehrte der Fall.

In Ostasien, Jahr.	Absolut.	Pro Mille.	Besatzungsstärke.
Auf den Schiffen, 1876–1908	169	0.5	61,007
Auf den Schiffen, 1897–1908	116	2.8	40,909
An Land einschl. Expeditionskorps, 1897–1908	84	3.8	61,007

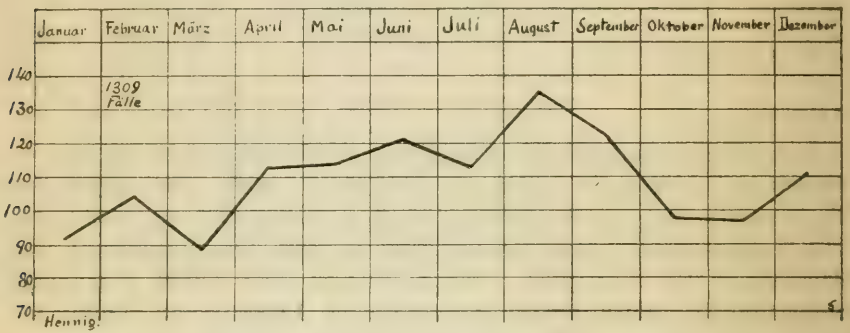
253 I. Anfälle.

Fleisch ist hier sehr gut und billig (ein Pfund Rindfleisch kostet beispielsweise nur ca. 50 Pf.), während Früchte und Gemüse kostbar sind und immer die Gefahr der Darmkatarrhe und Ruhr in sich bergen. Fleisch wird deshalb dort vorzugsweise und in grossen Mengen genos-

sen. Anders die Schiffe in Ostasien, wie auch die in den Erdteilen Afrika und Amerika. Diese fahren an der Küste entlang, und haben viel weniger Gelegenheit zu grösserem und andauerndem Fleischgenuss.

X. EINFLÜSSE DES TROPENKLIMAS UND DER JAHRESZEITEN.

Aus diesen Tatsachen und ihren im vorigen Abschnitt besprochenen Folgen erklärt sich die grössere Zahl der Blinddarmfälle in den einzelnen Ländern. Hierzu kommt aber für die tropischen Länder noch eine andere Ursache, die Hitzewirkung. Infolge dieser und der allgemeinen schwächenden Wirkung des Tropenklimas wird die Verdauung oft schwer geschädigt, und gerade die unteren Darmabschnitte erkranken besonders leicht. Dasselbe gilt für die Sommermonate, und der Monat August weist deshalb auch die meisten ersten Anfälle von Blinddarmentzündung in unserer Statistik auf.



XI. DIÄTFEHLER.

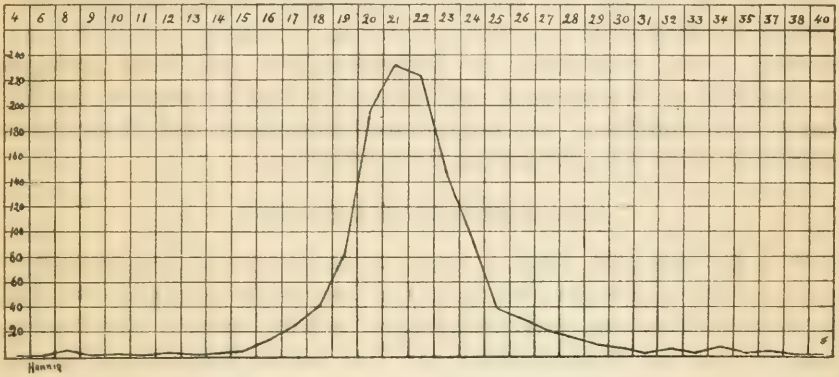
Die vielfachen, von den Marinemannschaften häufig (50 Mel = 3.6 Prozent) als Ursache angegebenen Schädigungen durch vieles Rauchen, Genuss von schlechten Nahrungsmitteln, kaltes Trinken und hin und wieder auch eine gewisse Übermässigkeit im Genuss vieler Speisen nach Entbehrung derselben auf Seereisen (wie z. B. Süssigkeiten, Fruchteis) berühre ich nur kurz, da sie selten wirklich von Bedeutung sind. Sie haben nur insofern höchstens eine Wirkung, als sie zu Darmkatarrhen führen und die Widerstandsfähigkeit der Blinddarmgegend gelegentlich noch mehr herabsetzen können.

XII. LEBENSALTER.

Nun bliebe noch die Frage zu erörtern, ob vielleicht in einem gewissen Lebensjahr sich eine Disposition zur Wurmfortsatzerkrankung herausbildet.

Wenn wir die Curve der 1,226 Fälle, in denen sich das Lebensjahr des ersten Anfalles nachweisen liess, übersehen, so finden wir die höchsten Erkrankungsziffern im Alter von 20–24 Jahren, also gerade

im Zeitraum der Marinedienstzeit, und das 21. Lebensjahr als dasjenige, in dem die meisten Wurmfortsatzentzündungen zum ersten Male in Erscheinung treten. Diese Anhäufung lässt sich meiner Meinung nach dadurch erklären, dass die Menschen unserer Rasse im allgemeinen mit 20 Jahren ausgewachsen sind; ihre inneren Organe haben also dann die volle Grösse erreicht. Bis dahin können Schädigungen, die an den Gefässen durch Verwachsungen in der Umgebung enstanden sind, oder die sich an der Wand des Wurmfortsatzes befinden, durch dessen Wachstum noch mehr oder weniger ausgeglichen werden, also landläufig gesagt, verwachsen. Nach Erreichen der Normalgrösse sind aber die früheren Schädigungen und ihr Verhältnis zur anatomischen Beschaffenheit des Wurmfortsatzes konstanter. Neu hinzu tretende Schädigungen durch Bakterien vom Darm aus können nun nicht mehr durch das Wachstum kompensiert



werden und der erste Anfall erfolgt leichter. So mag sich auch die Tatsache erklären, dass vom Anfang des 3. Lebensjahrzehntes an die Wurmfortsatzentzündung so gewaltig zunimmt.

Das Bild der für die Ursache der Wurmfortsatzentzündungen mehr oder weniger in Betracht kommenden äusseren Anlässe und Infektionskrankheiten ist, wie wir gesehen haben, ein sehr buntes.

Machen wir uns noch einmal ihre Wirkung klar, so finden wir, dass das Übergreifen der Infektionskrankheiten auf den durch seine anatomischen Verhältnisse zur Erkrankung disponierten Wurmfortsatz und die direkte Schädigung desselben durch äussere Einflüsse nur sehr selten die Appendicitis unmittelbar im Gefolge haben. Die Hauptbedeutung dieser Anlässe ist vielmehr die infolge ihrer Reizwirkung eintretende Hyperämie und Stauung in der Blinddarmgegend. Diese kann auch durch längeres Verweilen von Darminhalt hier entstehen und bewirkt Biegungen bezw. Knickungen am Wurmfortsatz. Andererseits führt sie, wie jede geringe Stauung an anderen Stellen des Darms, z. B. bei eingeklemmten Brüchen zeigt, leicht zur Bildung eines Exudats mit Fibrinniederschlägen und späteren Verwachsungen. Bei den Wurmfortsatzoperationen finden sich öfters

solche Fälle, die lediglich nur zartere oder gröbere Verwachsungen zeigen und sich als Reste derartiger alter Schädigungen erweisen, von denen der Träger nie eine Ahnung hatte. Die einseitige Blutversorgung der Appendixwand, die dem Endbezirk der im Mesenteriolum verlaufenden Arterie entspricht, bedeutet ja nur eine geringe Defensivkraft gegenüber den unverhältnismässig reichlichen Offensivfaktoren (Ebner).[44] Eine eintretende geringe entzündliche Schwellung, wie sie alltäglich überall im Darmkanal vorkommen kann, eine durch äussere Narbenbildung oder durch primäre oder secundäre pathologische Gefässveränderungen nur beschränkt mit Blut versorgte Stelle in der Schleimhaut genügt, um die Bakterien des Darmes dann in die Appendixwand einwandern zu lassen und den ersten Anfall hervorzurufen. Der Wurmfortsatz mit seinem engen Lumen, seinen vielen, nach dem Säuglingsalter sich entwickelnden Schleimhautbuchten, die häufig der Entleerungsrichtung entgegengesetzt sind, zwingt die Bakterien ja geradezu hier zu verweilen und sich anzusiedeln. Auch bewirken die wahrscheinlich nur sehr geringen peristaltischen Bewegungen und die vielfachen Stauungen des Inhalts vom Blinddarm her oder hinter Biegungen und Kotsteinen, sicherlich noch eine Steigerung ihrer Virulenz.

XIII. BAKTERIELLE INFEKTION.

Was die Bakterien selbst anlangt, so ist ihre Flora eine sehr reichhaltige, bald überwiegt nach den Angaben in der Literatur von den im folgenden genannten Arten die eine, bald die andere. Am häufigsten wurden im Wurmfortsatz zur Zeit seiner Erkrankung festgestellt, Bakt. coli commune, neben ihm Streptococcen, Diplococcus lanceolatus, Staphylococcus pyogenes aureus und albus. Hin und wieder Pneumococcen, Poycyaneus, Typhusbacillen und viele andere. Auch Ruhramöben wurden im Inhalt gelegentlich gefunden (Hoppe-Seyler).[45]

Auf Grund der Tatsache, dass vor 15 Jahren die Blinddarmentzündung noch verhältnismässig selten gewesen ist, während jetzt geradezu eine Epidemie herrscht, ist neuerdings von Hood im Lancet die Behauptung aufgestellt worden, dass Blinddarmentzündung eine selbständige Infektionskrankheit sei, also von einem Individuum auf das andere übertragen werden könne. Eine Kritik dieser Behauptung lässt sich natürlich erst dann üben, wenn das von Hood angeblich vorliegende Materiel geprüft werden kann. Aber alle Erfahrungen und wissenschaftlichen Beobachtungen haben bisher gerade das Gegentheil dieser Ansicht ergeben, dass nämlich eine Übertragung von Mensch auf Mensch ganz unmöglich ist. Die Fälle in denen in einer Familie mehrere Mitglieder an Blinddarmentzündung erkrankten und bei denen man an eine derartige Übertragung denken könnte, von 12 Fällen in der Marine erkrankten gleichzeitig

bezw. vorher: Der Vater bei 5 Leuten; ein Bruder bei 6 Leuten, eine Schwester bei 1 Mann.

Es erkrankten von den Familien-Angehörigen noch an Appendicitis: 1 Familienmitglied, 7 mal; 2 Familienmitglieder, 1 mal (2 Schwestern); 3 Familienmitglieder, 1 mal (2 Schwestern und der Vater), lassen sich aber auf andere Weise leicht erklären. Die anatomischen Verhältnisse des Wurmfortsatzes können durch Vererbung gleich schlechte sein, die Schädigung durch äussere Einflüsse, unzweckmässige Ernährung und die Disposition zur Erkrankung kann dieselbe sein und so können aus gleicher Ursache gleiche Wirkungen entstehen, ganz abgesehen von der Tatsache, dass eben die Appendicitis eine überaus häufige Krankheit ist. Nach Aschoff haben von den Menschen, die in der Blüte des Lebens stehen, mindestens jeder zweite und im 5. Lebensjahrzehnt gar schon 80 Prozent einen appendicitischen Anfall durchgemacht.

Das Marinematerial weist über bakteriologische Untersuchungen an Wurmfortsätzen nur sehr spärliche Aufzeichnungen auf, sodass man ein Urteil daraus nicht gewinnen kann, welche der Infektionserreger an der Entstehung der Appendicitis die Hauptschuld haben. Es wurden festgestellt: Bact. coli (in der Hauptsache), 3 mal; Bact. coli + Streptococcen, 1 mal; Pneumococcen, 1 mal; Diplococcen + Staphylococcen, 1 mal; Staphylococcen (in der Hauptsache), 1 mal; Streptococcen (in der Hauptsache), 1 mal; Tuberkelbacillen (als Nebenbefund), 1 mal.

Nachdem wir nun alle Gründe und Ursachen kennen gelernt haben, die zur Entstehung der Wurmfortsatzentzündung führen können, kommen wir zu dem Schluss, dass eigentlich nur die Tuberkulose ein wesentliches ätiologisches Moment für die Krankheit darstellt. Der grösste Einfluss aber für die stetigen Vermehrungen und den jetzt auch allgemein bestätigten schwereren Verlauf der Krankheit ist unstreitig dem von Jahr zu Jahr sich steigernden Fleischgenuss zuzuschreiben. Es bleibt nur noch der Hinweis, dass heutzutage entsprechend dem erhöhten Interesse, welches Arzt und Patienten den Erkrankungen in der Blinddarmgegend zuwenden, die Krankheit leichter und häufiger konstatiert wird. Manche Unterleibserkrankung, die man früher als Leibschmerzen, Verstopfung, Darmkatarrh, oder Lebererkrankung und Bauchfellentzündung ansah, erweist sich heute, wo man die Krankheit in ihren ersten schleichenden Anfängen viel besser kennen gelernt hat, als Entzündung des Wurmfortsatzes.

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AN INTERNATIONAL BASIS FOR NAVAL STATISTICS.

Surg. A. W. Dunbar, United States Navy.

The object in tabulating vital statistics is to afford a basis for the determination of the results of sanitary measures for the prevention of disabilities and of the effect of therapeutics. The value of such statistics is dependent upon their comparison, either with the returns of the same community or organization for similar periods in the past or with the returns of similar communities or organizations extending over the same period of time.

Naval vital statistics, when compared with those of civil communities, afford but a limited basis for comparison, owing to the different environment and the limitations as regards age and sex in the personnel of the military service. The conclusions derived from a study of naval as contrasted with army statistics is of more value, but it is only when navy is compared with navy that these returns become fully comparable. Unfortunately in the absence of a common nosology, and of a similar policy in regard to the admission and disposition of patients, such a comparison is accompanied by such uncertainty as to impair its value. It is therefore evident that the adoption of an international basis for the comparison of vital statistics is most urgent. To accomplish this end, it is necessary to agree upon a nomenclature for international use in which the titles have a common significance. Until such a nomenclature should be generally accepted by the medical profession it is not necessary nor desirable that it be adopted for the naval medical returns other than in the table for international use.

The Surgeon General of the Navy, in his annual report to the Secretary of the Navy for 1911, initiated the practice of publishing the naval medical statistics in titles of the international classification with the hope that foreign navies will reciprocate, and thus afford a convenient basis for comparison.

Aside from the necessity for a common nosology, a uniform method of recording the admissions and discharges of patients, as well as computing the sick days is requisite to insure accuracy. There should be an agreement as to what cases shall appear on the records. It is well known that it was a practice of some medical officers to simply excuse patients with minor ailments, such as gonorrhea, without admitting them to the sick list. The unreliability of vital statistics under such conditions is evidenced by the rise in the apparent naval venereal admission rate from 91 in 1908 to 160 per 1,000 in 1910, when all cases were by order admitted, if only for record.

In a similar manner the results of treatment as appearing in the returns of sick may be deceptive unless there be a uniform method of indicating the final service termination of the cases.

The statistician is interested in (1) the admission rate, (2) the invaliding rate, (3) the death rate, and (4) the discharges to duty, and the tables should always show these facts. To eliminate as far as practicable erroneous diagnosis, the transfer of patients as with "Diagnosis undertermined" has been authorized in our Navy where, through lack of time for observation or of clinical facilities, the nature of the disease is not then determinable, and for these and also for such diagnoses as are proved to be erroneous the use of the designation "Discharged for change of diagnosis" is allowed.

In the case of the necessary discharge of a patient from the official sick list due to the expiration of enlistment the indeterminate ending "Transferred" (T) is used, indicating a transfer to the supernumerary list.

The proper method of disposing of patients transferred to a naval sanatorium for tuberculosis or to the Government Hospital for the Insane, who rarely return to duty, is one which is of peculiar interest in our Navy. It appears best to regard such transfers as equivalent to an invaliding from the service, which is now done.

The above indicates some of the points upon which there should be a uniformity of procedure in the interests of accuracy. The etiology of diseases is generally evident, but the character of an injury gives little clue to the cause. The international classification of the causes of injuries is adapted for use by the Navy as well as by the civil community, but its titles should be subdivided or extended to cover those more applicable to the militant forces, such as explosions of guns, magazines, boilers, or casualties inflicted in action. The Navy, as well as the civil community, has its questions of occupational hygiene, and the results of the efforts of the sanitarian, when not

directly involving military efficiency, should on humanitarian grounds be the property of all.

While the admission rate for disabilities does or should show the true incidence of disease, the statistician is also interested in the loss of service due to diseases and injuries. Aside from the loss of service due to sick days, there is a distinct injury inflicted upon the Navy through the loss by death or invaliding of a more or less trained individual, which collectively may be termed "damage."

In the study of returns to determine the relative damage sustained the comparison of these three factors renders it difficult to properly weight the result as a whole. It is therefore desirable to have some method of expressing these three factors in a single term. In this connection I believe the method devised by Medical Director J. D. Gatewood, United States Navy, and fully explained in his work on Naval Hygiene, is worthy of more extensive recognition in military statistics than it has been accorded. In brief, the method consists in arbitrarily considering that the damage inflicted by a death or an invaliding is equivalent to six months' sickness or loss of service for an individual for that period of time. This loss of service is then expressed in a percentage of sick which, added to the percentage of sick obtained from the actual sick days, gives the damage percentage, by means of which the equivalent number of individuals on the sick list throughout the year may be determined. It is not claimed that this represents the actual damage, but it does afford a valuable and graphic basis for comparison, and for this purpose has been published in the last two reports of the Surgeon General.

In the international classification we have the framework upon which to build a common nomenclature, and the recent movement to adopt a complete nosology under this classification for the medical profession of this country is a forward movement which undoubtedly will be adopted by other countries.

With accurate, consistent, and understandable tables of vital statistics the naval sanitarian will be able to decide upon the efficacy of prophylactic measures in his own as well as in other navies, to the end that the tale of human suffering may be lessened and that naval service may conduce to the physical well-being of the individual.

INTERNATIONAL BASIS FOR NAVAL STATISTICS.

Surg. Charles N. Fiske, United States Navy.

The presentation of this subject in this section seems a timely indication for an appeal to our colleagues of foreign naval services to promote a better understanding of our similar endeavors; in fact, to foster a closer professional acquaintance. We have, to be sure, a certain incentive and opportunity to profit by each other's experi-

ences in our Association of Military Surgeons of the United States, which each year tends toward, in fact, what I believe it soon should in name, an international association. Yet a perusal of the programs for the annual meetings of military surgeons leads one to feel that the topics treated are selected at random and lack sufficient basis for showing what might be systematically discussed for our mutual profit and instruction.

Our first and, for present considerations perhaps, longest step toward knowing each other's work better should be the adoption of some method for expressing measurements of morbidity and physical disability for naval services generally in common terms. There are commonly exchanged between the executive headquarters of the several naval medical establishments one or a few copies of our periodically published medical and sanitary reports with statistics, but this appears to be merely a graceful act of courtesy which we feel with propriety might readily be construed as willingness to do far more if we only knew how.

These reports are received at very irregular intervals; some cover the calendar year preceding publication, one is published but once in two years and after considerable delay incident to a better classification of its statistical data, while another appears to cover a fiscal year.

Sometimes there appears to be such haste in publication that only the obvious and self-declared important facts are emphasized, while the more subtle, however important their elucidation might prove, are abandoned in the effort to formulate material for the following year.

Suppose, for a moment, that we finally have before us the medical reports of the six relatively important navies which pertain to a period already three years behind us. Some may feel at once that they are too old to be of much present value; yet after a little study it will be found that those more recently issued and more delayed in publication have been compiled with such care and absence of haste that they must possess more value, at least for the countries which issued them. Some reports have statistical tables and charts scattered throughout the text which, coupled with the lack of familiarity with the language used, tends to confuse the student who wishes to compare movements of disease in the several services. However, the greatest concern will be felt on account of there being no uniformity in disease nomenclature and methods of tabulating statistical facts. We may promptly recognize many of our nosological terms in foreign tongues, but perhaps not the majority, and as for puzzling out the precise intended meaning of the abbreviated column headings, we are tempted to feel that national methods of expression are irreconcilable as if we belonged to intellectually different species. The navies of France,

Italy, and the United States have already used to a varying extent the International Classification of Diseases and Causes of Death, the constant numbers of which furnish a key to the causes of disability studied.

To small or short-sighted minds this international classification may seem so far from attaining perfection that it would hardly satisfy any one nation even as a *list*, and of course as a "classification" it is far more susceptible of destructive criticism, yet it is the best we have and can be trusted to improve with each decennial revision.

In this connection the following quotations from Appendix II, Mortality Statistics, 1908, Bureau of the Census, are pertinent:

It is evident that much of the value of the statistical tables relating to causes of death will be lost if they are not fully available for comparative purposes. A universal statistical classification of causes of death that should be used by every city, State, and country in the world that publishes mortality reports has been the hope of vital statisticians for many years. This end has not yet been attained, although there is a greater degree of correspondence between all of the national methods of classification at present than in times past, and a large number of nations of the world have united in the use of an absolute identical system known as the International Classification of Causes of Death and Sickness, the second decennial revision of which has just taken place under the auspices of the French Government, at Paris, July 1 to 3, 1909. * * * The purpose of the decennial revision, as expressed in the original propositions therefor made by the American Public Health Association in 1898 and indorsed by the International Statistical Institute in 1899, is that the classification may be kept abreast of the constantly advancing knowledge of pathology, so that the sanitarian and physician who desires to consult the official statistics of causes of death will not be obliged to employ obsolete and discarded medical terms. For the same reason the Nomenclature of Diseases of the Royal College of Physicians of London has been revised every 10 years since 1869, and the American Medical Association, through its committee on nomenclature, is planning a similar authoritative work for this country, which will likewise need to be kept up to date by periodic revisions. * * * The orthography of the list, which differs somewhat from that previously used in the annual reports, is that recommended by the committee on nomenclature of the American Medical Association. Lastly, in examining the general form of the "classification," it should be remembered that the scientific classification of diseases, in the primary sense of the word, is a thing apart from the object of this list, which is merely a list of causes of death, arranged by international agreement for use in mortality tables. The use of the word "list" in this connection is strongly recommended by such eminent authorities as Dr. Arthur Newsholme and Dr. John Tatham, and follows in the practice of the latter in the table of the causes of death in the annual reports of the registrar general of England, wherein only the individual causes are presented, and the so-called classes or groups of diseases are dispensed with. A motion to dispense with the "classes" in the international system nearly prevailed in Paris, but the general opinion favored the retention of the "classification" as a mere skeleton upon which to arrange the all-important individual titles for at least one decade more. In the annual reports on mortality statistics prepared by the Bureau of the Census very little attention will in the future be paid to the "classes" of diseases, and the word "classification," which is familiar to registration officials and the statisticians in the special sense of a mere tabular arrangement of causes of death (see Mortality Statistics, 1907, p. 22), will be abandoned more and more in favor of the terms "list" or "tabular list."

The medical departments of armies did not wait for the general adoption of the International List. The International Commission for the Unification of the Medical Statistics of Armies first agreed upon its list of 38 diseases and disease groups at Budapest in 1894, since which time there have been but two modifications—Madrid in 1903 and Berlin in 1907. The Bertillon international classification has been gradually achieving adoption throughout the civilized world for civil vital statistics, and doubtless would have been gladly utilized by the army surgeons at Budapest had it then been so widely used.

Medical Inspector Gatewood, in his Naval Hygiene of 1909, states that—

> The vital statistics of the Navy * * * represent an analysis which is necessarily at the foundation of all inquiry of sanitary progress. * * * The statistics of any one year, however recent, have little value except that evolved through comparison with those of prior years. * * * Statistics of recent years have some values peculiarly their own, but also other very important values that depend exclusively upon comparison with the statistics of antecedent years. With an understanding of the methods employed and of the data relating to recent years, it will be practicable for anyone to utilize the material available in any future year and to make the comparison that may be desired. * * * The diseases of our Navy are the diseases of all other navies, but there seems to be no way of determining, with even a reasonable degree of accuracy, whether the relative importance of the different diseases is much the same in the different services. There are not only differences in nomenclature, but also of methods, which are more disturbing in attempts at comparison. Navies are not much interested in the comparison of their vital statistics with those of armies, but much good could be accomplished by an international convention for the adoption of a nomenclature of diseases to be used by all naval services and an international form of returns that could be utilized for comparison in connection with a detailed statement of methods employed.

To satisfy local ideas, peculiar needs and conditions of each naval service the International List may be expanded with the greatest freedom, much as has been done by Bellevue Hospital, of New York City, by the medical department of the United States Army, and by the author for the United States Navy, *provided only that the international numeration be strictly followed.*

After being charged with the compilation and interpretation of naval morbidity statistics for two years I attempted to show in the United States Naval Medical Bulletin for April, 1911, how easily a navy's statistical tables could be translated into terms of the "International," and in part stated:

> The want of international naval medical statistics has long been felt, and particularly regretted, since the development of the international military medical statistics of the armies of Bavaria, Prussia, Belgium, Denmark, Spain, France, Great Britain, Holland, Italy, Japan, Portugal, Russia, Sweden, Norway, and the United States. In this international nosological list for armies Latin was used for the reason that the present International Classification or List had not been developed, the titles are few (only 38), and the numbers are really all that is required for international comparison.

By the mere publication, as an appendix to the report of the Surgeon General of the Navy, of its combined table translated by key numbers into terms of the unexpanded International List, our own service could well take the initiative. It is believed that this method will be the one most likely to appeal to the naval services of other countries, and perhaps most promising of results in inducing them to do likewise without the necessity of any formal convention.

The readiness with which the civil authorities of other countries are adopting the International List, or adapting it to their needs, lends encouragement to the hope that naval services may be far better served than have the armies with their very limited Latin list.

The arrangement of table or tables adopted may for the present be well left to the judgment of each navy, unless we may cherish the hope that the form of our own table will, as a pioneer effort or precedent, influence others to use similar column headings. With this in view, and the understood intention of the Bureau of Medicine and Surgery to compile such a table in its next annual report, I have been led to translate such a table to embrace the Navy's morbidity statistics for the calendar year 1909. In accordance with the suggestion of Medical Inspector Gatewood, readmissions and transfers to hospitals (other than those for treatment of insane and of tuberculosis) have been eliminated as having little significance to those outside the service and being even misleading to ourselves. The discharges to duty have been adjusted to make up the total of all cases not otherwise disposed of. * * * One objection to the unexpanded International List which would promptly occur to every medical officer is that the nomenclature was primarily designed for the compilation and statistical comparison of *causes of death*, while a military service requires full *morbidity* statistics as much as those for mortality. This objection is shared by the large civil hospitals and is what the efforts of all English-speaking vital statisticians with the American Medical and American Public Health Associations are now trying to meet. It is assured that the revised "Manual" contemplated by the Bureau of the Census and the American Medical Association list will be sufficiently comprehensive for the purposes of Government medical officers, and the principle of subexpansion found in the accompanying list should solve the problem for the Navy in a manner quite as satisfactory as it has for the Army since 1904.

A mere perusal of the work of the last decennial revision of the international nomenclature is enlightening, and even the list itself with its synonyms is educational. In these days of preventive medicine one can seldom anticipate what affection may achieve importance in the near future. This is not alone confined to exotic diseases. Within recent years pellagra, hookworm, amæbiasis, typhus fever, poliomyelitis, cerebrospinal meningitis, and even Mediterranean fever have attracted attention in the United States of America, and who shall say that we may not yet find that the miliary fever of Europe has not been with us unrecognized? Apparently chancroidal infection is not separately reported in the naval statistics of some countries, and one would be led to believe that but two venereal diseases were recognized.

After the several navies have adopted a uniform nomenclature for causes of disability another particularly essential step should be uniformity in the compilation and publication of morbidity tables. Such details as the inclusion of data regarding officers, as well as all men on the active list, the exclusion or separate consideration of reserves and inactive pensioners and insane at naval

homes, sanatoria, and asylums, naval patients treated at other than service hospitals, the retirement of officers for physical disability being equivalent to invaliding enlisted men from the service, the separate consideration of recruits, midshipmen, and marines while under training, the vexed question of readmissions to obviate duplication of cases and the character of service, occupational, voluntary, compulsory, reserve, etc., should all be thrashed out in correspondence or personal conferences of officers representing the several Governments.

Typical tables could be readily worked out from study of reports of every navy by one vital statistician officer in whom the head of each naval medical department placed entire confidence, and, after agreement as to general principles and when duly authorized, notes could be exchanged, preferably directly, to settle any points at issue, and finally reports signed by all conferees would be submitted to each department for formal action.

Is it the concensus of naval representatives at this congress that some such effort should be undertaken? If so, I call for an appropriate resolution to which should be invited the attention of the chief administrative officer of each naval medical department, in order that officers may be delegated without delay to enter into correspondence upon this duty. And although it should not be necessary among members of the humane profession who should be the first to encourage international comity and cooperation, let me observe that mutual assistance, compromise, and concession should be kept in mind rather than any spirit of domination or lack of faith in the best intentions of coworkers. It is partly for this reason that I refrain from submitting any specially arranged forms which might to me seem to possess sufficient merit to urge for adoption. After we have once succeeded in getting together in full sympathy and with open minds I am confident that the details will prove far from insurmountable.

FRIDAY MORNING, SEPTEMBER 27, 1912.

INTERNATIONAL BASIS FOR NAVAL STATISTICS.

Dr. Cressy L. Wilbur, Chief Statistician, Bureau of the Census, Washington.

There are well-recognized differences between the vital statistics of ordinary civil life and those of the military and naval services. Nevertheless the basic principles and requirements governing their construction and use are largely identical. It is desirable that all vital statistics shall be comparable, and a large part of the energy of working statisticians during recent years has been expended in the effort to bring this about. We are at the beginning of success in civil mortality and morbidity statistics through the general adoption of

the International List of causes of sickness and death, and it may be hoped that a like degree of uniformity may be secured in military and naval mortality and morbidity statistics.

The most important and perhaps the most difficult part of mortality statistics relates to the compilation and presentation of the statistics of causes of death. Special difficulty is experienced in dealing with the causes of death returned by physicians in civil life, for the reason that there is, as a rule, no authoritative nomenclature of diseases to which their returns must conform. It is not practicable to prepare statistical tables showing in detail each of the thousands of medical terms reported for any considerable area. Hence all statistical compilation of causes of death has been, to a certain extent, a process of condensation of terms reported under certain statistical titles. For example, international title No. 1, "typhoid fever," includes all deaths reported by physicians from "typhoid fever," "enteric fever," "typhomalarial fever," "paratyphoid fever," etc. The exact content of each title is known from the conventional grouping shown in the tabular list, and it is the chief merit of the international system that it first gave such a list so that the statistical compiler and student could know exactly what was comprised under each statistical title.

Such a statistical list is in no sense a nomenclature of diseases, because it is necessary for general purposes that it should include many indefinite and otherwise unsatisfactory terms that are in use by physicians. It is desirable, however, that a nomenclature should be framed that will correspond in its general arrangement to the statistical list, so that physicians will have an authoritative guide to the use of correct medical terms in making their reports. The preparation of such a nomenclature has been undertaken by the American Medical Association for the United States, and it has been suggested that cooperation may be had with the committee of the Royal College of Physicians of England, whose nomenclature has been the standard in that country for 40 years, in the preparation of the next revision. If arranged in the international order, or if the next revision of the International List conforms to the plan of th nomenclature, it will furnish, with its complete synonyms in Latin, French, German, Spanish, and perhaps Italian, a most admirable basis for improved mortality and morbidity statistics throughout the world.

It is not essential, of course, for the construction of a nomenclature of diseases that its arrangement should correspond precisely to the form adopted for a statistical list. It would add greatly to the convenience of its use for statistical purposes, however, if this could be done, and there would seem to be no reason why the standard nomenclature and the statistical lists should not agree in their general

order of statement. It is hoped that this consideration may be given weight in the next revisions of each. The old idea of a "scientific classification" of diseases has been largely abandoned, so that the guiding principles are chiefly those of providing a definite designation for each disease entity or condition from the point of view of nomenclature and of presenting a correspondingly definite list of statistical titles for the purposes of statistical compilation.

The practical adaptation of the International List to hospital purposes, in which greater exactness in regard to the reporting of diseases can be required than is feasible for general mortality statistics, has been successfully accomplished by the committee on clinical records of Bellevue and allied hospitals, New York, and their nomenclature of diseases and conditions is in use in many hospitals in this country as well as in some abroad. It contains an arrangement of all terms that are allowed to be used under the titles of the International List, and attending physicians and internes are required to use those terms, discarding entirely more or less indefinite synonyms, and also to insert the international numbers, so that the compiler of the hospital statistics is enabled to work with absolute precision. The Surgeon General of the Army, which has long employed the International List for its mortality and morbidity statistics, has also published a Manual for the Medical Department, in which a definite nomenclature is presented in the order followed by the Census Office and the Bellevue Hospital nomenclature. Several valuable papers have appeared in the United States Naval Medical Bulletin, by Medical Director Gatewood[1] and Surgs. Dunbar,[2] Pleadwell,[3] and Fiske,[4] the article by Surg. Fiske containing a complete tabular comparison of the titles of diseases and causes of death of the International List with those of the Latin nomenclature now employed by the Navy and the Army (international) nomenclature, together with a presentation of Table 18 of the Report of the Surgeon General, United States Navy, 1910, showing all morbidity, invalidings, deaths, and damage for calendar year 1909, translated from Navy Nomenclature to International List (unexpanded).

Examination of this important table as rearranged by Surg. Fiske according to the international order is, to the civil vital statistician and presumably to the average physician familiar with general vital statistics, much more convenient and satisfactory than that of the original. This statement is made without a suggestion of criticism of the classification and Latin nomenclature heretofore employed by the Navy. While it is recognized that the chief purpose of the naval statistics is to permit comparisons to be made by the medical officials of the conditions of healthfulness of the Navy from year to year, it is also important that the medical profession of the country and medical statisticians generally should study the data. A statistical classification

must be comprehended as a whole before it is safe to extract therefrom any item of particular information, and it is an advantage of the international system that, once understood in its general structure, convenient and safe use may be made of the data compiled thereunder by various offices. It would seem that even in its unexpanded form it answers the purpose of a general statistical list for the presentation of morbidity, invalidings, deaths, and damage for the Navy fairly well, and there is, of course, no difficulty in expanding or contracting it to any desired extent, as is in fact done in the Army (international) nomenclature, so that it will be made perfectly adapted to naval purposes.

All titles relating exclusively to sickness or deaths of women and children should, of course, be omitted. Some objection has been made that the treatment of deaths from external causes in the ordinary list as used for civil purposes is not satisfactory as applied to Navy returns. While it is desirable that the main subdivisions of the International List should be retained in order to show the number of deaths from the various forms of suicide, homicide, and accidental injuries, together with the means of injury, a subdivision of international title No. 186 should provide for deaths in war, with as full detail as may be desired as to whether killed in battle and the means of death, and also an entire alternative section should be constructed in which a complete statement should be given of all deaths from external causes according to the nature of the injury, including character of weapon, etc. Such a list would present little difficulty, its total would agree with the total compiled according to the regular international titles under external causes, and it would be comparable also with hospital statistics in which a similar grouping has been found necessary. A special list of surgical operations might be appended in which the causes for which the operations were undertaken should be arranged in international order under the heading "Disease or injury," with the name of the operation or its nature in the following column somewhat as in the tables of operations in the Statistical Report of the Health of the Navy (Great Britain, 1910, p. 153), but with the advantage of a uniform order, so that comparisons are more readily made between the various hospitals. In general, it is urged that any desired degree of precision be required in the returns of sickness or causes of death (prescribed nomenclature), but that for statistical tables a uniform or conventional order of arrangement, which will be just as readily instituted and far more serviceable if it conforms to the international order, be adopted.

There is no special complexity about military or naval morbidity or mortality statistics in general that requires a totally different classification of diseases from that found useful in civil statistics. The naval data are readily put into international order, as Surg. Fiske

has shown experimentally. Reference to the Statistique médicale de la marine of France (1906) reveals a nomenclature (statistical list) which has many points of resemblance to the International List, which the Government of France has done so much to bring into general use throughout the world, but, so far as appears to the casual observer, possesses no advantages over the International List. In the French Navy list, as used in various tables, some minor differences appear that would be obviated by the use of the International List. For example, the first title of the French Navy list is "Fièvre éphémère" in the table on page 12 (Malades à bord) and other tables, while in the table on page 24 (Malades à l'hôpital, à terre) No. 1 of the list is "Courbature." The terms may be used synonymously, but it would seem preferable, for official statistics, to employ uniform titles, the significance of which, moreover, if based upon the International List, would be universally understood. So also in the valuable tables upon "Die verschiedungen Erkrankungen auf den einzelnen Schiffs- und Landstationen," pages 152–194, of the Sanitätsbericht über die Kaiserlich Deutsche Marine, 1907–8, the order at first appears to be that of the statistical lists recommended by the imperial board of health, and probably could have been presented with equal advantage according to that arrangement, with provisions for supplemental statement of nature of injuries such as has already been suggested in connection with the international. The English reports on the morbidity and mortality of the Navy likewise correspond to a considerable extent to the system of classification and general arrangement at that time employed by the Registrar-General of England and Wales. Since the adoption of the International List by Great Britain it is presumed that the Navy lists will be brought into correspondence with it. The time would seem to be at hand, therefore, for general agreement among the military and naval services of the world for a somewhat condensed or slightly modified service statistical list for compiling morbidity and mortality statistics, each title in which should bear a definite relation to the corresponding international titles as used in civil statistics, so that the vital statistics of armies and navies will not only be more conveniently comparable among themselves, but also with the vital statistics of the civil populations from which their constituents are derived, and with which, with proper allowance for age and sex distribution, the relations in time of peace should be very important.

[1] The Medical Man and Vital Statistics, U. S. Naval Med. Bull., Jan., 1912.

[2] A Plea for a More Liberal Nomenclature for the Naval Medical Service, ibid., Jan., 1912.

[3] Report on the Second International Conference for Revision of Nomenclature of Diseases and Causes of Death, held at Paris July 1–3, 1909, ibid., Oct., 1909.

[4] Nomenclature for Causes of Physical Disability in the Navy, ibid., April, 1911.

DISCUSSION.

CHARLES N. FISKE, surgeon, United States Navy: It is very unfortunate that the symposium on naval vital statistics had to be divided and advanced in date, so that one paper defaulted and no connected discussion, when numerous naval medical officers from several navies were present, was permitted. By request of the president I herewith present the following resolution, in the drafting of which Medical Director Gatewood collaborated, and which seems to meet the views of officers of our own Navy:

FIFTEENTH INTERNATIONAL CONGRESS ON HYGIENE AND DEMOGRAPHY,
SECTION VIII, MILITARY, NAVAL, AND TROPICAL HYGIENE,
September 27, 1912.

Whereas, the medical departments of the several navies have no uniform methods for expressing morbidity or motality statistics, either in nomenclature for causes of disability, or in compilations and tabulations of returns; and

Whereas, the International Classifications of Causes of Death and Sickness should form a basis to secure uniformity in all naval vital statistics; therefore be it

Resolved, That the secretary-general of the Fifteenth Congress on Hygiene and Demography, now in session in Washington, is directed to communicate to the Governments of France, Germany, Great Britain, Italy, Japan, Russia, the United States of America, and such other Nations as publish naval medical returns, that it is the sense of this congress that each Government should designate naval medical representatives to confer and recommend uniform methods and tables for expressing internationally naval vital statistics.

The proceedings of the Joint Session of Sections I and VIII are found in Volume I, Part II.

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